EXHIBIT 2

UNITED STATES DISTRICT COURT
MIDDLE DISTRICT OF NORTH CAROLINA

SHAUNA WILLIAMS, et al., *Plaintiffs*, v. REPRESENTATIVE DESTIN HALL, in his official capacity as Chair of the House Standing Committee on Redistricting, et al., *Defendants*.	Civil Action No. 23 CV 1057
NORTH CAROLINA STATE CONFERENCE OF THE NAACP, et al., *Plaintiffs*, v. PHILIP BERGER, in his official capacity as the President Pro Tempore of the North Carolina Senate, et al., *Defendants*.	Civil Action No. 23 CV 1104

EXPERT REPLY REPORT OF DR. JONATHAN RODDEN

October 17, 2024

I. INTRODUCTION AND SUMMARY OF FINDINGS

I have been asked to reply to the expert reports of Dr. Trende and Dr. Barber, both of which responded to my initial expert report in this case. Both reports make some version of the same two claims. First, they make the surprising claim that contrary to my initial report, the congressional districts drawn by the North Carolina General Assembly in 2023 do not sort Black voters in and out of districts in any way. They imply that impressions to the contrary are illusory artifacts of the methodology used in my initial report. Second, they claim that even if the districts do sort Black voters in and out of districts, this is purely a byproduct of the General Assembly's effort to craft an extreme partisan gerrymander in favor of the Republican Party. This report responds to both claims.

First, my initial report used an approach developed by Dr. Stephen Ansolabehere to evaluate racial sorting in districting maps. This approach combines map visualizations, quantitative and qualitative analyses of traditional redistricting criteria, measurement of racial differences between the voters included and excluded in specific districts among those residing in the encompassing counties (the "envelope" approach), and measurement of racial differences between those moved out of the previous districts and into the new districts ("in-out analysis"). The Trende and Barber reports do not challenge my characterizations of violations of traditional redistricting criteria in the 2023 Plan and do rather little to challenge the veracity of the descriptive statistics presented in the tables in the main body of my report. Rather, Dr. Trende and Dr. Barber focus primarily on the regression analyses presented in the appendix, while questioning the value of using individual-level data from the voter file rather than precinct-level data and of the "envelope" and "in-out" approaches to measurement generally. They also offer some alternative analyses that would seem to indicate that the 2023 Plan did not, in fact, sort voters in and out of districts according to race.

I respond to several additional points below, but the central conclusions of this report include the following:

- The "envelope" and "in-out" approaches to measurement are local and context-specific and should not be divorced from analysis of local demographics and traditional redistricting criteria.

- Dr. Trende and Dr. Barber critique my use of individual-level data from the voter file, but evidence of racial sorting remains quite strong even if one relies on aggregate precinct-level census data rather than individual-level data. The disadvantage of precinct-level data is that it precludes efforts to differentiate race from party.

- Dr. Trende suggests that it is better to focus only on precincts that are immediately adjacent to the district boundary rather than focusing on all precincts in the district's envelope. Even if we focus on adjacent precincts on either side of district boundaries in the Piedmont Triad and Charlotte areas, evidence of racial sorting is very strong.

- Dr. Barber argues that the correct standard for evaluating the distribution of race across districts is to conduct race-blind simulations. The simulations Dr. Barber generates reveal that the 2023 Plan is an extreme outlier: it packs Black voters into two districts with the largest Black populations and spreads the rest evenly across the remaining

districts to a far greater extent than any of his race-blind simulations. In the 2023 Plan, Black voters are far more packed in Charlotte, and far more evenly distributed across districts in the Piedmont Triad, than in any of Dr. Barber's simulated maps.

In sum, it is abundantly clear that Black voters have been sorted in and out of the districts of the 2023 Plan in a highly unusual way. The answer to the question of whether this is completely explained by the General Assembly's effort to achieve an extreme pro-Republican gerrymander, however, is difficult to obtain because of the very high correlation between race and party in North Carolina. When two variables are highly correlated, nothing can be learned from regression models that include both in the same model. Unfortunately, such models feature heavily in both the Barber and Trende reports. That said, there are several additional ways to assess whether partisan gerrymandering fully explains the stark correspondence between race and district boundaries in the 2023 Plan:

- My initial report demonstrated that racial sorting was evident among registered Democrats, Independents, and Republicans. Barber and Trende merely point out that Black Republicans are few in number, which is true enough, but they do not undermine the observation that district lines separate Black and White voters among Democrats and Independents, and many Independents in North Carolina typically vote disproportionately for Republican candidates, which allows us to observe racial sorting among a group of voters that often votes for Republicans.

- I examine Dr. Barber's simulations, focusing on the plans that produce 10 or even 11 Republican seats—meeting or surpassing the partisan achievements of the 2023 Plan—and find that Black voters are still highly packed and cracked in the 2023 Plan relative to even those extremely pro-Republican plans.

- I examine all the other draft plans produced in discovery that were either considered by or available to the General Assembly in the months before they adopted their final plan, some of which were clearly predecessors of the final plan, and others of which were alternatives that were ultimately rejected. Each of these plans were extremely pro-Republican gerrymanders and achieved the same partisan goals as the 2023 Plan, yet the 2023 Plan—the map the legislature settled on after trying several different configurations—packed and cracked Black voters more than any of its predecessors or alternatives.

II. DOES THE 2023 PLAN SORT VOTERS BY RACE?

In my initial report, I demonstrated that in the Piedmont Triad and Charlotte areas, and to a lesser extent in the Northeast, when we leave aside whole counties and focus on district boundaries that are drawn *within* counties, those boundaries correspond very closely to racial divisions. Specifically, Black communities in the cities of the Piedmont Triad were carefully carved up and spread out over three different predominantly rural districts, and Black voters in the Charlotte area were packed into District 12 and kept out of Districts 8 and 14. I also demonstrated that these maneuvers required a disregard for traditional redistricting criteria. These patterns are very clear simply from visualizing race across district boundaries. However, I also attempted to quantify the extent to which these districting choices led to the sorting of voters by race.

To do so, I relied on two techniques previously presented in expert reports by Dr. Stephen Ansolabehere. First, I compared the demographics of the voting-age population placed in or held out of the challenged districts, focusing on the group of counties that "envelope" the district. Second, I examined the demographics of places that were moved into and out of the districts of the plan being replaced. With both approaches, it is possible to quantify the extent to which the district boundaries divide voters according to race. The main tables in my report merely provide these descriptive facts. I also estimate regression models that control for distance from the median population center of the district and whether the voter lives inside or outside the major cities whose boundaries may have been of interest to district-drawers, in order to examine the possibility that these racial differences are mere artifacts of the locations of groups of voters relative to the district being drawn, or the desire to keep certain cities intact.

The Trende and Barber reports do not dispute the veracity of my calculations of racial differences between VTDs kept in and out of specific districts in the 2023 plan using data from the voter file. Nor do they dispute my characterizations of the plan's violations of traditional redistricting criteria. Rather, they focus on some rather technical aspects of the "envelope" and "in-out" approaches. First, they argue for the use of precinct-level data rather than individual-level data. Second, Dr. Trende makes two contradictory claims about the appropriate study area for the envelope analysis. And third, both reports make a broad claim that even if we accept my measurement of the racial differences between the areas kept "in" and "out" of the districts of the 2023 Plan, we have no good way of knowing whether such differences may have emerged from a race-blind redistricting process. I discuss each critique in turn.

Individual-level versus precinct data

The Trende and Barber reports are critical of the use of individual-level data from the North Carolina voter file in Ansolabehere's report as well as in my report. The measurement exercise here is quite simple, and one can draw very similar inferences about the racial differences between those on either side of the boundary whether one aggregates individual-level self-reported race from the voter file, or census data at the level of census blocks or VTDs. Dr. Barber argues that one should only trust data at the level of VTDs, since these are the geographic units selected by district-drawers when building districts. Both Dr. Barber and Dr. Trende claim that by using individual-level data, I was somehow imagining that individuals can be carved out of their VTDs or blocks. In fact, I was using the VTDs in the voter file to assign individuals to districts, and then aggregating self-reported racial data. This is not much different from assigning VTDs to districts and then aggregating decennial census data, which is ultimately also an individual-level survey of self-reported race. In any case, if we follow the approach recommended by Dr. Barber and use VTD-level census data, we get almost identical results. In Table 1, I reproduce the "envelope" analysis from my initial report using the VTD-level dataset included in Dr. Barber's replication materials.

Table 1: Envelope Analysis Using Census VTD-Level Data Rather than Individual-Level Voter File Data

Area	Group	VAP of Group in Envelope	VAP of Group in CD 6	% of Group that is in CD 6
CD 6	Total	1,169,621	578,293	49.4%
	White	709,926	382,738	53.9%
	Black	290,520	111,667	38.4%
				-15.5%

Area	Group	VAP of Group in Envelope	VAP of Group in CD12	% of Group that is in CD12
CD 12	Total	860,025	580,319	67.5%
	White	412,145	229,032	55.6%
	Black	265,577	222,293	83.7%
				28.1%

Area	Group	VAP of Group in Envelope	VAP of Group in CD14	% of Group that is in CD 14
CD 14	Total	1,253,544	579,505	46.2%
	White	708,805	410,318	57.9%
	Black	323,388	92,298	28.5%
				-29.3%

Area	Group	VAP of Group in Envelope	VAP of Group in CD 1	% of Group that is in CD 1
CD 1	Total	626,903	587,229	93.7%
	White	321,785	297,700	92.5%
	Black	248,378	237,415	95.6%
				3.1%

Table 1 is very similar to the comparable tables in my initial report. For instance, I wrote that the difference between the share of White registered voters included in District 6 and the share of Black registered voters included in District 6 was 13.2 percentage points. When we use VTD-level census data instead, the difference is slightly larger: 15.5 percentage points. The difference between the two groups in District 12 in my initial report was 29.4 percentage points, whereas using census data it is 28.1 percentage points. In District 14, the difference between the groups in my initial report was 28.4 percentage points, whereas using census data, it is 29.3 percentage points. In District 1, the difference was 3.6 percentage points in my initial analysis, and 3.1 percentage points here. In sum, critiques of the use of individual-level data from the voter file are misguided, since aggregate census data tell almost exactly the same story. The downside of using aggregate data, of course, is that it does not allow us to measure the partisanship of those included and excluded from districts or moved from one district to another—which I was able to do in my initial report using individual-level voter file data.

Neither Dr. Trende nor Dr. Barber provides descriptive statistics using data from VTDs in his report. Rather, for reasons that are unclear, they focus on running regressions using VTDs as the units of observation. Dr. Barber estimates regressions for each envelope, coming to the surprising conclusion that in spite of the obvious correspondence of race with district boundaries when visually inspecting maps, and in spite of the data presented in Table 1 above, there is no statistically significant relationship between the BVAP of a precinct and its likelihood of being included in (or out) of one of the challenged districts.

How does Dr. Barber reach this conclusion? Dr. Barber's regressions include two variables—BVAP and Democratic vote share—that are extremely highly correlated. This is a phenomenon known to statisticians as "multicollinearity." A very basic lesson from any introductory statistics course is that researchers may not include two such variables in the same regression, since such regressions produce coefficients and standard errors that are nonsensical. Economist Badi Baltagi states the problem succinctly in his introductory textbook: "the higher the multicollinearity among the regressions, the lower is the reliability of the regression estimate."[1] A typical rule of thumb is that when the correlation coefficient between two variables approaches around .7 or .8 or higher, severe multicollinearity is present, and the coefficients and standard errors of any model that includes both variables are essentially meaningless. Note that a correlation coefficient of 1

[1] Badi Baltagi, *Econometrics* (Springer 2d Rev. ed., 1999), page 134.

indicates perfect correlation. In Dr. Barber's VTD-level dataset, the correlation between the Democratic vote share and BVAP is .85 in the envelope of District 6, .88 in the envelope of District 12, .82 in the envelope of District 14, and .96 in the envelope of District 1. Therefore, in the context of these county envelopes, regressions that include both of these variables are of no value. The coefficients and standard errors of such models are meaningless.

To understand the intuition of the multi-collinearity problem, think of a financial analyst who would like to predict stock prices. She has a great deal of information about each business, including a measure of past performance as well as market capitalization. However, past performance and market capitalization are highly correlated, since the stocks of companies with strong performance in the past have experienced increased demand for their stock, increasing their market value. If the researcher runs a regression including both variables along with several other variables, she may note that the coefficient for past performance is positive and statistically significant, while that for market capitalization is negative and not statistically significant. She then notices that if she drops the past performance variable from the regression, suddenly the coefficient for market capitalization is large, positive, and statistically significant. Further, she might notice that if she keeps both variables in the model, but adds and removes other control variables, the coefficients for these two variables change dramatically—sometimes even changing their sign. Interpreting the coefficients in such models would lead to misguided inferences, for instance that strong past performance is associated with a lower stock price.

The same thing is happening with race in Dr. Barber's regressions. As is typical when a regression is plagued by severe multicollinearity, as in the example above, the sign and magnitude of coefficients change wildly when control variables are added or removed from the model. The standard solution is simply not to include the highly correlated variables in the same model, but rather to choose only one of the variables. This may be a disappointment to a researcher who wishes to disentangle the effects of the two highly correlated variables, but a different research design is needed, like that pursued in Section III of this report. Here, we can include party *or* race in these VTD-level regressions, but we cannot obtain sensible coefficient estimates if we include both. In Table 2, I use Dr. Barber's data and code, but simply drop "Republican vote share" from the regressions.

Table 2 reveals that VTD-level regressions also reveal the racial differences between the areas included and excluded from the challenged districts that can be seen in Table 1 above and in my initial report. We can see that in Districts 6, 12, and 14, the coefficient for "Percent Black" is statistically significant, indicating that within each district's respective envelope, as the share of Black voters grows, the VTD is less likely to be included in Districts 6 and 14, and more likely to be included in District 12.

Table 2: Estimation of Barber's VTD Regressions without Multicollinearity

	Estimate	Std. Error	t value	
District 6				
Intercept	0.966	0.060	15.978	***
Percent Black	-0.422	0.077	-5.501	***
Total Population	0.041	0.012	3.541	***
Distance	-0.024	0.002	-12.564	***
Greensboro	0.000	0.055	-0.002	
High Point	0.510	0.034	15.127	***
District 12				
Intercept	0.918	0.108	8.474	***
Percent Black	0.372	0.080	4.676	***
Total Population	-0.001	0.007	-0.179	
Distance	-0.069	0.007	-9.676	***
Charlotte	0.239	0.087	2.766	**
District 14				
Intercept	1.026	0.047	22.027	***
Percent Black	-0.291	0.068	-4.291	***
Total Population	0.018	0.007	2.569	*
Distance	-0.007	0.002	-4.011	***
Charlotte	-0.759	0.040	-18.993	***

Dr. Trende also relies heavily on regressions that are plagued with multicollinearity in his report. He uses individual-level data from the voter file and includes individual-level race and party in the same regression. Like Dr. Barber, he obtains nonsensical results. The most sensible estimates using individual-level data are those in my initial report.[2]

[2] Dr. Trende also criticizes the stata command I used to translate logit coefficients into effects that can be interpreted by readers. There is nothing "incorrect" about the approach employed by the "dprobit" command. As the stata software platform has evolved, the syntax has changed, but the older syntax is still functional. One way to obtain a marginal effect is to take the average of the data and calculate the estimated slope. Another way is to calculate the slope at every available datapoint and then calculate the average of those slopes. My initial report took the former approach, and Dr. Trende's report took the latter. In any event, the differences in estimated marginal effects are quite small.

Dr. Trende and Dr. Barber seem to suggest that the way to disentangle race and party in this context is to include both in the same regression, and if the coefficient for race is larger than that for party, or statistically significant for race while that for party is not, they would declare racial predominance, and if the opposite is true, they would declare partisan predominance. Dr. Trende appears to conclude, on page 74 of his report, that party predominated in the drawing of District 6, based on the observation, in Figure 39 on page 75 of his report, that the coefficient in his logit model was statistically significant for party but not race. However, later on page 95 of his report, he seems to conclude that race was predominant in the drawing of *both* Districts 12 and 14. Writing about District 12, he says "here that coefficient (for race) is larger than the politics variable. The same is true of District 14." Writing about the impact of race, he goes on to say that "If we control for politics that probability drops to 5.1%, although it is larger than the effect from politics." Unlike in his analysis of the Piedmont Triad area, he does not include regression tables for either District 12 or 14 in the Charlotte Area, and he rather abruptly ends his discussion without much commentary on his conclusion of racial predominance in Charlotte.

However, from Dr. Trende's analysis, we can neither conclude that party was predominant in District 6, nor that race was predominant in Districts 12 and 14. Nor can we conclude anything about racial or partisan predominance from Dr. Trende's so-called "boundary" regressions or from Dr. Barber's various VTD regressions, including those conducted for each of his simulations. Each of these regressions is hopelessly plagued with multicollinearity. This is precisely the advantage of Dr. Ansolabehere's approach to the use of individual-level data on party registration. It allows us to examine racial differences across districts *within* partisan groups without resorting to regressions that are essentially meaningless. I will return to this issue in Section III.

What should the study area be?

Dr. Ansolabehere's "envelope" approach was constructed to give a great deal of deference to the decisions of the district-drawers. It takes as given the specific arrangement of counties that form the basic architecture of each district, focusing only on the final decisions about which VTDs to include or exclude in the counties that were split. The presumption is that there were many possibilities available to the district-drawer even within that basic architecture, and the question is whether they chose an arrangement that sorted voters by race.

Dr. Trende makes two seemingly contradictory critiques of this approach. On the one hand, he seems to suggest that the counties selected by the district-drawers should *not* be taken as a given, offering in Figure 10 on page 36 a much more expansive concept of how we might think about the "envelope" of District 6. In fact, in medium gray font in his map in Figure 10, he suggests that most of the population of Western North Carolina, including Mecklenburg County, covering a territory reaching all the way from the state's northern border to its southern border, should be included in the envelope of District 6—an area whose population is sufficiently large to produce three congressional districts. I do not see a way to implement the envelope approach in such a large area, given the geographic distribution of county boundaries and the role of other districts in the envelope, and notably, Dr. Trende does not offer one. In dark gray font in the same map, Dr. Trende suggest an approach to specifying an envelope that completely ignores county boundaries, seemingly suggesting the consideration of alternative maps that ignore country boundaries. Again, I do not see how this suggestion can possibly be implemented, and Dr. Trende does not try to do so.

On the other hand, a few pages earlier in his report, Dr. Trende argued that the Ansolabehere approach gives *too little* deference to the district-drawers. He complains that the "envelope" approach imagines, inappropriately, that a non-contiguous VTD, perhaps separated by three or four VTDs from the district boundary, could have ended up in the district. Such VTDs most certainly could have ended up in the district with a slightly different configuration, as Dr. Trende demonstrates in Figures 7 and 8 of his report. Following Dr. Ansolabehere, my approach was to allow for the possibility of alternative configurations within each county, while controlling for the distance from the core of the district to reflect the fact that more distant VTDs were less likely candidates for inclusion. However, Dr. Trende argues that I should have focused on *contiguity* rather than proximity. In other words, he argues that I should have given maximum deference to the district-drawers, imagining that the only possible way to draw the district was exactly the way it was drawn, and the only relevant decision points worthy of analysis were the final set of VTDs selected along the boundary of the district. His claim seems to be that it is inappropriate to entertain even slight variations in the district's shape within the split counties. In Dr. Trende's recommended approach to contiguity, the only VTDs outside the district that can be considered as alternative candidates for inclusion are those in the envelope and left out of the district but immediately across the boundary from VTDs that were placed in the district. In my view, this approach is far too limited and fails to consider other possible ways of splitting the county.

Figures 1 and 2 below are reproductions of Dr. Trende's choropleth maps of VTD-level BVAP in the Piedmont Triad and Charlotte Areas. The colors on the map shift from yellow to green to blue as BVAP increases. Dr. Trende is suggesting that we should analyze only the VTDs on either side of the district boundaries in these maps. From visualizing the maps, it certainly *seems* likely that he would find racial differences on either side of the district borders within the split counties. Note the correspondence between race and the placement of the boundaries in several places, especially around Winston-Salem, Greensboro, High Point, and Charlotte. Remarkably, however, he runs some regressions from which he concludes that there is no difference between VTDs on either side of the border.

Figure 1: Reproduction of Dr. Trende's Choropleth Map of the Piedmont Triad

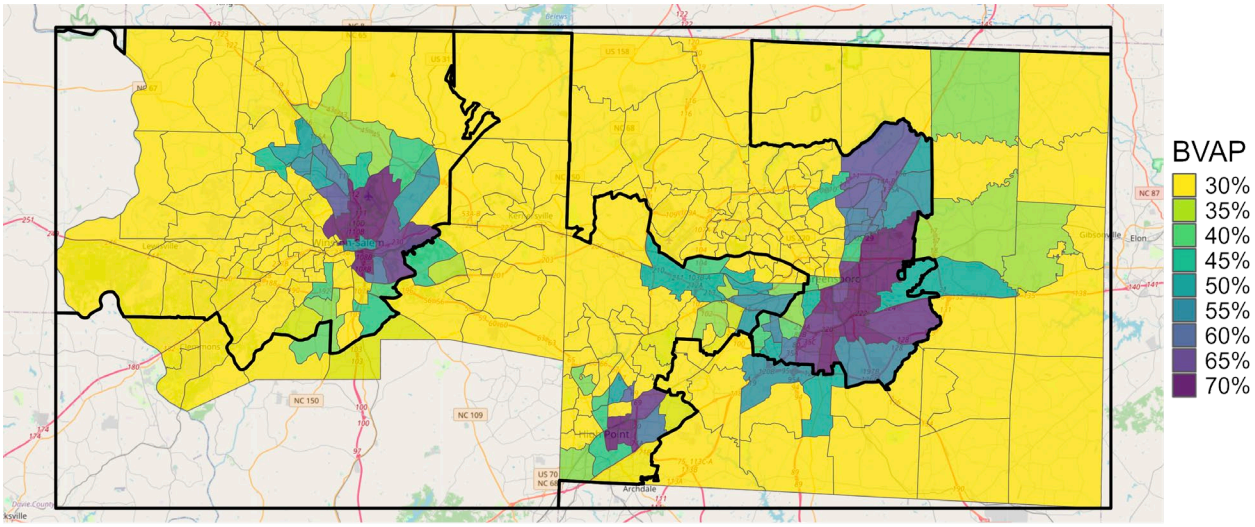
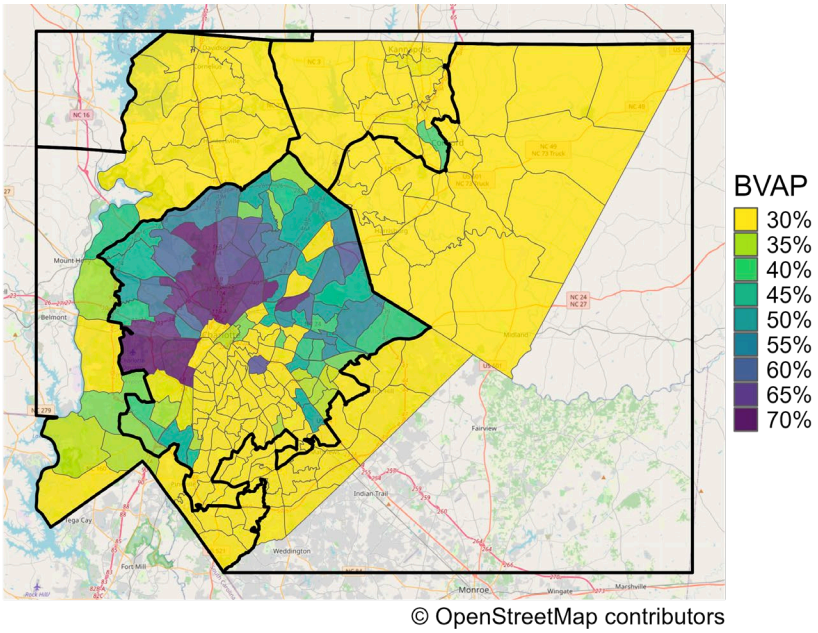


Figure 2: Reproduction of Dr. Trende's Choropleth Map of the Charlotte Area



How did Dr. Trende obtain such a counter-intuitive result? First, his regressions are once again plagued with the multicollinearity problem, since he includes both party and race in the same regressions. Second, he is doing exactly what he claims *not* to be doing: comparing far-flung non-contiguous VTDs with one another. My understanding is that he is not comparing pairs of VTDs on either side of the border, but rather, combining all "border" VTDs" into a data set, without any consideration of contiguity, such that he is effectively comparing VTDs from very different parts of the border, or perhaps even different borders of the district.

The only sensible way to achieve what Dr. Trende seems to want to do in his "boundary" analysis is to construct a list of matched VTDs on either side of the relevant boundary. There is no need to run regressions. It is sufficient to simply examine the difference in BVAP between the VTDs on either side of the boundary. For each split county within the envelope of each challenged district, I locate the VTD on the boundary of a district and identify the contiguous VTD or VTDs on the other side of the boundary,[3] and compare the BVAP on either side of the boundary. The results of this analysis are set forth in Appendix 1, which provides lists of border VTDs in the split counties of the Piedmont Triad and Charlotte Areas along with the BVAP on each side of the border and the difference between the two. At the bottom of the table for each border segment, I calculate the average BVAP difference between all cross-border pairs.

[3] In most cases there is a single contiguous VTD, but sometimes, if the VTD on, say, the West side of the border is relatively large or elongated along the border, there will be two or, in rare cases, even three contiguous VTDs on the East side of the border. In such cases, I calculate the combined BVAP of all three.

Looking at the boundary between Districts 5 and 9, the BVAP is larger on the District 5 side of the boundary for 13 of the 16 border VTDs in District 5 (81 percent), and the average difference is around 18 percentage points.

Next, at the boundary between Districts 6 and 9, there are 10 boundary VTDs in District 6, and the BVAP is higher than in the adjacent cross-border VTDs in 9 of them (90 percent). The average difference in BVAP is around 23 percentage points.

Next, at the boundary between Districts 6 and 10, there are 13 boundary VTDs in District 10, and the BVAP is higher than in the cross-border VTDs in 11 of them (85 percent), and the average difference is 12 percentage points.

At the boundary between Districts 6 and 8, there are 11 boundary VTDs in District 6, and the BVAP on the District 6 side is higher in 10 of them (91 percent), with an average BVAP difference of 9 percentage points.

There are 22 VTDs on the District 12 side of the border with District 8, and BVAP is higher on the District 12 side in 18 of them (82 percent), with an average difference of around 11 percentage points.

Finally, consider the boundary between District 12 and District 14, where for 16 of the 19 boundary VTDs in District 12, or 84 percent, BVAP is higher on the District 12 side. The average difference is around 18 percentage points. See the appendix for further details on each boundary segment.

Dr. Trende's "border" regressions invite the reader not to believe their eyes when viewing his choropleth maps. His regression analysis based on border VTDs drew the rather surprising conclusion that the boundaries of districts in the Piedmont Triad and Charlotte do not correspond to race. In fact, the opposite is true. The visual impression generated by his maps, and those in my initial report, are not misleading. The observed differences in BVAP across district boundaries are remarkably consistent and large—around 15 percentage points on average across all of the VTD pairs—indicating that boundaries correspond very closely with the residential locations of racial groups. In sum, even if we adopt Trende's strict approach to contiguity, there remains strong evidence of racial sorting.

What is the appropriate benchmark?

It is abundantly clear that there are differences between the racial composition of the VTDs on either side of district boundaries in the 2023 Plan, but both the Trende and Barber reports ask the additional question: compared to what? How can we know whether the differences are large or small? More broadly, how can we know whether the sorting of Black voters into and out of District 6, or into District 12, is unusual in any sense? How can we rule out that the distribution of Black voters in the 2023 Plan would not have emerged from a race-blind redistricting process?

Dr. Ansolabehere's "in-out" analysis adopts the perspective of voters living in a state and electing members of Congress in a district. It examines the racial composition of groups moved into new districts, where they would be joined with a new set of voters, potentially face a different incumbent and set of candidates, and must organize with a different group of voters to achieve policy objectives. In my initial report, I used the plan in place for the 2022 elections as a

"benchmark" for the "in-out" analysis. Both Dr. Trende and Dr. Barber suggest that it would have been more appropriate to have used the legislatively enacted 2021 Plan that was never implemented because it was overturned by state courts as a benchmark. The "in-out" analysis is focused on the movement of voters from a district they voted in previously to their new district, and I do not see the logic of considering voters to have been moved "in" and "out" of a plan that was never implemented. Even if the new plan was drawn from scratch, without any concern for prior district boundaries or the residential locations of incumbents, the only sensible benchmark for the "in-out" analysis is the plan used in the most recent election.

A remaining question about benchmarks for both the "envelope" and "in-out" analyses is: how should we interpret the magnitude of racial differences? First, the size of the racial differences in the tables of my initial report are quite difficult to interpret without the accompanying discussion of the geographic context. For instance, most of the districts, especially those in the Piedmont Triad, were drawn to artificially suppress the Black share of the population by dividing proximate Black communities into different districts. This means that in some cases, districts were drawn to keep Black voters *in* one part of a district where it abuts another district with *too many* Black voters; whereas in another area, voters are kept *out* of the same district where it abuts another district with relatively few Black voters. For example, Black voters from Winston-Salem were kept out of District 6 and placed in rural District 5, but Black voters in High Point were kept in District 9 rather than placed in District 9. The overall effect was that within the envelope, Black voters were less likely to be placed in District 6, but this only tells part of the story, where the key takeaway is that Black voters were "cracked" in the Piedmont Triad area to be spread out relatively evenly across the districts. This results in a 19 percent BVAP in Districts 5 and 6, and a 22 percent BVAP in District 9.

The tables in my initial report provide a quantitative measure of the racial sorting using techniques that have been recognized as valuable in previous court decisions, but they cannot be interpreted in isolation from the specific context of the map in question. Dr. Trende points out that the racial difference between those placed "in" and "out" of District 6 within its county envelope is smaller than those of the districts addressed in *Cooper v. Harris*, but this is not surprising, since both districts at issue in *Cooper v. Harris* were instances of racial *packing* rather than cracking. In fact, as Dr. Trende points out, the racial difference in District 12's envelope is not much different than those in *Cooper v. Harris*. This is not surprising, since District 12 is an instance of racial packing that is comparable to *Cooper v. Harris*.

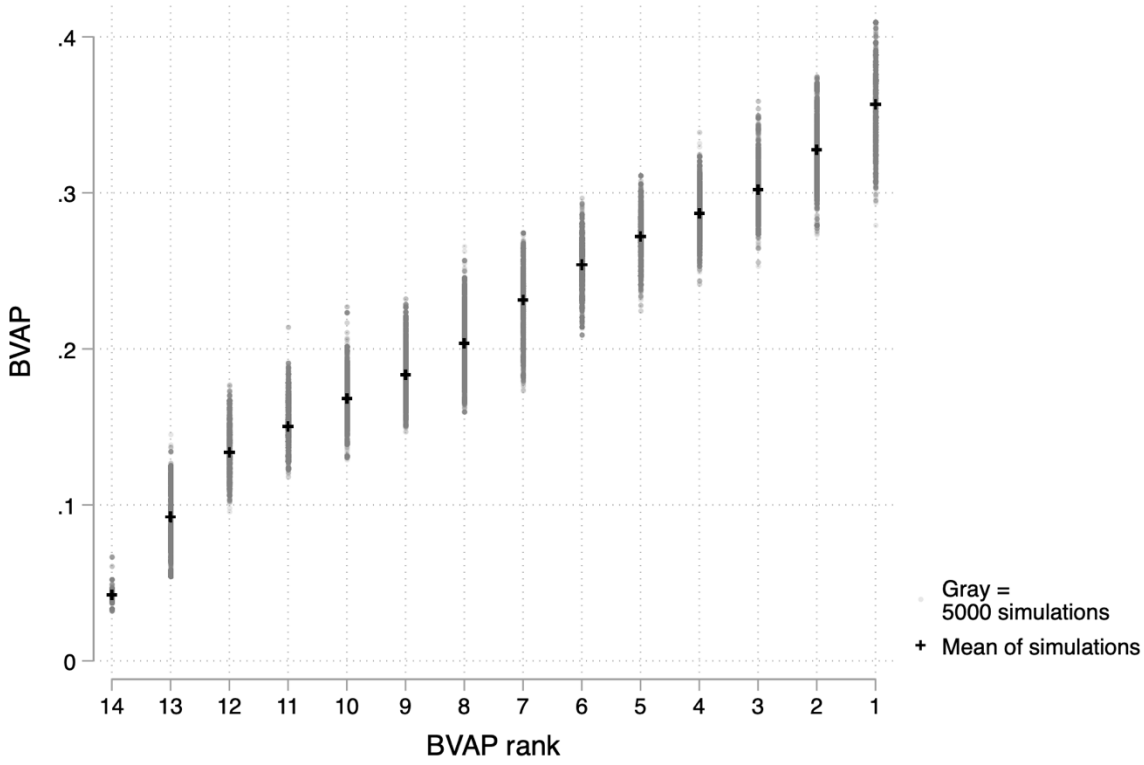
Dr. Barber points out that without further information, it is difficult to interpret the magnitude or statistical significance of racial differences between areas within the county envelope that are kept in and out of a specific district. He points out, correctly, that a statistically significant difference between the racial characteristics of the VTDs kept "in" and "out" of a district within its envelope might emerge purely because racial groups are clustered in space. To demonstrate this, he simulates 5,000 alternative congressional redistricting plans for North Carolina without paying any attention to race and shows that statistically significant differences emerge within county envelopes of the simulated districts quite often.

Dr. Barber's simulations are conducted in a way that draws relatively compact districts with minimal county splits. In a county like Mecklenburg, for instance, the simulation algorithm will frequently slice through the middle of the county with a boundary reaching from the East side of

the county to the West, leaving Black voters relatively more concentrated on the North side of the boundary than on the South side, even though the boundary does not correspond to the racial dividing line of Mecklenburg County. Dr. Barber is correct, then, to note that raw racial differences within the envelope are difficult to interpret without accompanying maps and analysis of traditional redistricting criteria.

My initial report and the analyses I undertake above therefore provide important context: Visual inspection of maps and analysis of data on compactness and jurisdictional splits, combined with the descriptive statistics of the "envelope" analysis and the "boundary" analysis above convey that there is something unusual in the way Black voters are concentrated in District 12 and split across the Piedmont Triad districts in the 2023 Plan. But Dr. Barber's simulations provide a powerful way to verify that this is the case. As Dr. Trende says in his report, it is useful to have a "realistic assessment of the null hypothesis (ie. what a race-neutral draw is)." Dr. Barber's simulations aim to provide this. For reasons that are unclear, after going to the trouble of producing an ensemble of 5,000 race-blind simulations, Dr. Barber does not take the obvious next step of comparing them to the 2023 Plan.

Figure 3: The Distribution of Black Voting-Age Population in Simulated Plans



In Figure 3, using a common technique in the academic literature on redistricting, I rank the districts in each simulated plan from the highest to lowest BVAP (Black voting-age population share). This "BVAP rank" is plotted on the horizontal axis of Figure 1—from the district with the lowest BVAP on the left to the district with the highest BVAP on the right—and the BVAP of each district in each simulated plan is represented with a gray dot. At the far right, for instance, at rank 1 (the district with the highest BVAP), there is a set of gray dots ranging from a little under

30 percent to a little over 40 percent, representing the range of BVAP values that the district with the highest BVAP fell in all the simulated plans. The next cluster of gray dots to the left ranges from around 28 percent to around 38 percent. This means that in the 5,000 simulated maps, the district with the second-highest BVAP falls in this range. The relatively wide range of gray dots at each rank indicates that there are many different ways to draw a race-blind congressional map in North Carolina with 14 districts. The only exception is on the far-left side of Figure 1, at rank 14, which plots the lowest-ranked simulated districts in terms of BVAP. Here, the simulations produce a rather tight range around 4 percent. This is due to the natural geography of the state—there are only so many ways to draw the far Western part of North Carolina, and all of them produce a very similar, and very low, BVAP.

Note that there is also a black "plus" sign in the middle of each set of gray dots. This represents the mean of the simulations at each rank. We can expect that a race-blind plan, drawn to keep counties whole and keep the districts relatively compact, would not deviate very much from those means. If we array the BVAP of a specific plan in ascending order in the same way, we should expect the observations to fall within the range of the gray dots. This would indicate that the distribution of race across districts was largely in line with what would be expected from a race-blind process that respected county boundaries and attempted to draw relatively compact districts.

Next, in Figure 4, I add in the 2023 Plan. We can see in Figure 4 that the distribution of race in the 2023 Plan is quite different from what we would expect in a race-blind draw. In 5,000 simulations, it was very rarely the case that the BVAP in the district with the largest value was as high as that of the first-ranked district in the 2023 Plan—which was District 1. Moreover, there was not a single simulation in which the second-ranked district had a BVAP as high as the second-ranked district in the 2023 Plan: District 12. This is a powerful indication that the packing of Black voters in Districts 1 and especially 12 are indeed quite unnatural.

Next, we see that the districts with BVAP ranked 3 through 5 have BVAPS that are well below the lowest value in *any* of the 5,000 simulations, and the same is almost true for the 6th-ranked district. On the left-hand side of Figure 2, we see that the 13th-ranked district has a BVAP well *above* the entire range of the simulations, and the districts ranked 9 through 12 are quite high relative to the mean of the simulations.

Figure 4: The Distribution of Black Voting-Age Population in Simulated Maps Versus 2023 Plan

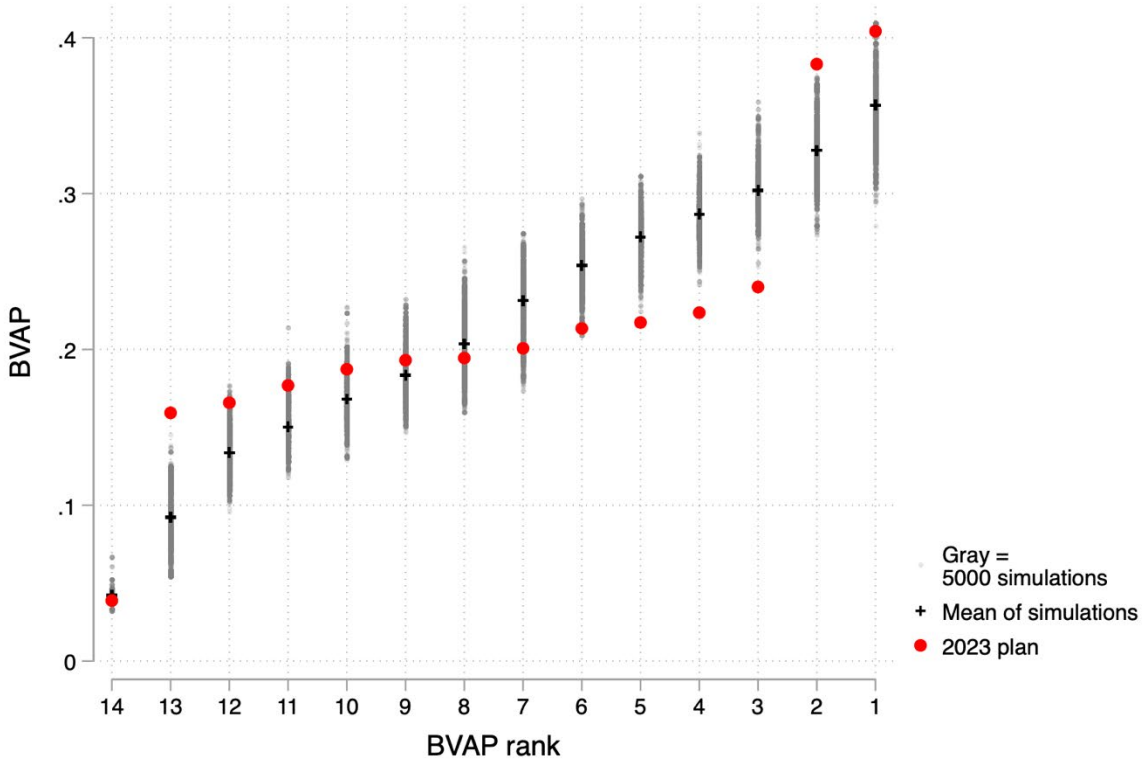


Figure 4 is a powerful indication that Black voters were packed into Districts 1 and 12, and carefully dispersed elsewhere to keep the BVAPs in a very tight range between 16 and 24 percent, whereas for the same ranks, the mean of the simulations ranged from 9 percent to 30 percent. The average simulated map produced 6 districts with BVAP of 25 percent or greater, whereas for the 2023 Plan, there were only two.

To comprehend the extent to which the distribution of Black voting-age population in any specific plan deviates from the simulations overall, we can calculate an indicator.[4] At each rank, we can calculate the difference between that plan's BVAP and the mean of the simulations. We can then square these values to give them all the same sign and make sure the positive and negative deviations don't cancel each other out. We can then add together these squared deviations to get a measure of the extent to which any individual simulated plan deviates from the rest of the ensemble of plans. This gives us the total deviation from average BVAP share in the ensemble for all the districts in each specific plan. For ease of interpretation, we then take the square root. When we calculate this quantity for each simulated plan, we have a good sense of the range of deviations that can be expected in 5,000 race-blind plans. We can then calculate this quantity for the 2023 Plan and compare it with the entire range of values for the ensemble of simulated plans. I do this

[4] Bangia, Sachet, Christy Graves, Gregory Herschlag, Han Kang, Justin Luo, Jonathan Mattingly, and Robert Ravier (2017). Redistricting: Drawing the Line. 10.48550/arXiv.1704.03360.

in Figure 5, which presents the values for all the simulated plans in the form of a histogram, and the value for the 2023 Plan with a red line.

Figure 5: Histogram of Index of Deviations from the Mean of the Simulations for all Simulated Plans, Compared with Value for Enacted 2023 Plan

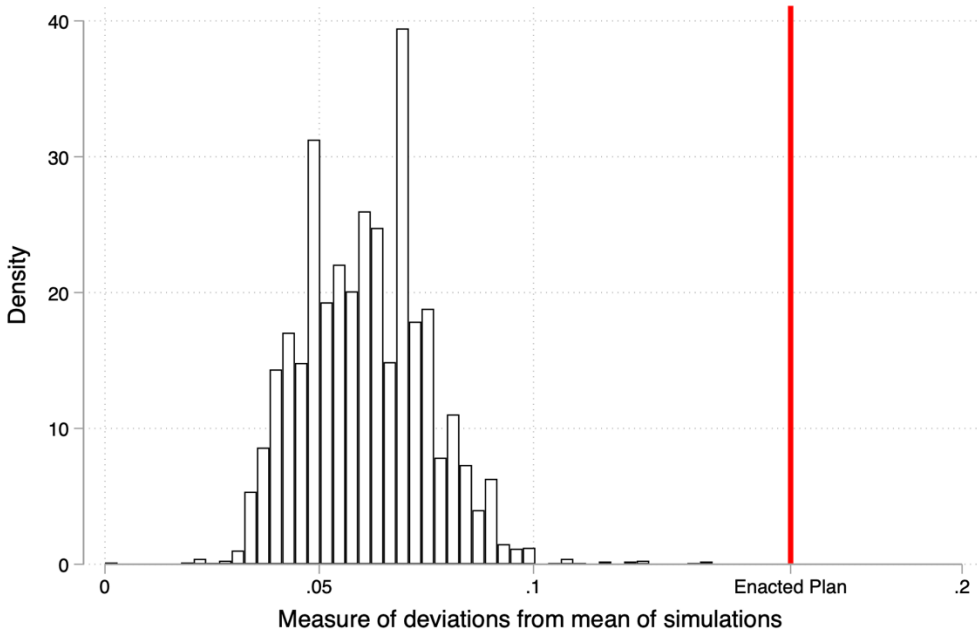


Figure 3 indicates that relative to the race-blind simulations, the 2023 Plan is an outlier. A similar deviation never emerges in any of the simulated plans.

III. RACE VERSUS PARTY

It is clear from the foregoing analysis that the districts of the 2023 Plan sorted voters by race, and that they did so in a way that was extremely unlikely to have emerged by chance. However, the question remains: was this racial sorting a mere byproduct of efforts to draw an extreme partisan gerrymander? After all, I noted above that race and party are highly correlated in North Carolina. Dr. Barber contends that the legislatively enacted 2021 Plan (which was struck down) was an extreme partisan gerrymander, and that the 2023 Plan is even more extreme. In a state where voters are quite evenly divided in statewide races, the 2023 Plan produces 10 Republican-leaning districts, 3 Democratic-leaning districts, and 1 highly competitive district. Dr. Barber and Dr. Trende argue that even if the districts appear to sort voters by race, they also sort voters by party. Efforts to create the ideal partisan gerrymander, they argue, *required* all the racial sorting described above and in my initial report. In other words, partisan gerrymandering required that Districts 1 and 12 be intentionally packed with Black voters in order to keep Democrats out of Districts 14 and 8, so that the Charlotte area would produce only a single Democratic district. It required that Black neighborhoods be carefully carved out from their residential contexts in order to produce a lower BVAP, and hence a lower Democratic vote share, in each district in the Piedmont Triad so as to ensure that not a single Democratic district might emerge there. Dr. Trende's report describes these partisan maneuvers in detail.

But merely pointing out that the 2023 Plan was an extreme partisan gerrymander, or providing partisan interpretations of various districting decisions, does little to demonstrate that racial considerations did not motivate the drawing of district lines. As described above, regressions including both race and party do nothing to help us disentangle the role of race and party. In the remainder of this report, I discuss three ways of doing so. First, I revisit the Ansolabehere approach, which uses individual-level data from the voter file to examine racial sorting within each partisan category. Second, Dr. Barber's own simulations prove that the level of racial sorting in the 2023 Plan was not necessary to reach the intended partisan objectives. Third, I examine a number of extremely partisan draft maps that were either drawn or directed by the General Assembly, and demonstrate that, again, the level of racial sorting in the 2023 Plan was not necessary to achieve partisan objectives.

Individual-level data from the voter file

The key advantage of the Ansolabehere approach in North Carolina is that it is possible to examine racial sorting *within* each partisan category and avoid running meaningless regressions that include both race and party. This approach is not possible in most other states because self-declared party and race are not available on the voter file. Dr. Barber specifically states that the Supreme Court, in its *Alexander* decision, noted a preference for precinct data over individual-level data from the voter file. The opposite is true. The Supreme Court noted that "Professor Ansolabehere's analysis operated at the voter level. []. That enabled him to compare the demographics of the moved voters to the general population in a way that [another expert's]'s precinct-level analysis cannot." *Alexander v. S.C. State Conf. of the NAACP*, 602 U.S. 1, 31, n. 9 (2024).

Both Dr. Trende and Dr. Barber also express a concern that it may be inappropriate to draw inferences about the partisanship of an area from individual-level data on party registration. However, using individual-level data is a common strategy among empirical political scientists, including Dr. Barber himself. In a 2014 paper, co-authored with Dr. Kosuke Imai, Dr. Barber collected party registration data from the voter files of several states, including North Carolina, aggregated it to the level of precincts, and compared it with precinct-level election results, concluding that "the correlation between party registration and election returns is high, suggesting that registration records are a reasonable measure of partisanship" (page 12).[5] He presents data suggesting that the correlation between actual voting behavior and party registration is extremely high in North Carolina. The remainder of the paper then goes on to use the registration data as its primary measure of partisanship. Many other political science papers follow a similar strategy.[6]

[5] Michael Barber and Kosuke Imai, "Estimating Neighborhood Effects on Turnout from Geocoded Voter Registration Records," available at: https://imai.fas.harvard.edu/research/files/neighbor.pdf

[6] See, for instance, J.R. Brown and Ryan Enos. 2021. "The Measurement of Partisan Sorting for 180 Million Voters. *Nature Human Behavior* 5(8), pages 998-1008; Enrico Cantoni and Vincent Pons. 2022. "Does Context Outweigh Individual Characteristics in Driving Voting Behavior? Evidence from Relocations within the United States." *American Economic Review*, 112 (4), pages 1226–72.

Neither Dr. Trende nor Dr. Barber offers any reason why any of the inferences in my report would be undermined by a correlation between party registration and voting behavior that is slightly less than perfect. Dr. Barber merely seems to point out that, if relying on individual-level registration data rather than actual election results when drawing districts, a partisan map-drawer might end up with a slightly different measure of partisanship. However, party registration data might be quite useful in addition to a variety of election results. It is with knowing, for instance, that in some areas, those who vote for Republicans in some races are registered as Independents, and hence might be less reliable in other races. In any case, it is not clear how some small amount of error in measuring partisanship would explain the fact that voters in the 2023 Plan were sorted in and out of districts by race within each partisan category.

In fact, the Trende and Barber reports do very little to contradict the finding that racial sorting is quite strong among Democrats and Independents. Trende points out, quite rightly, that Black registered Republicans are rare in North Carolina, especially in the areas around the challenged districts. I agree with his assessment that as a result, we cannot draw strong inferences about racial sorting among registered Republicans. However, Dr. Barber's report, and his paper with Dr. Imai discussed above, observe that in many areas of North Carolina, Republican vote shares are a bit higher than Republican registration shares, "suggesting that Independents in North Carolina are voting mainly for the Republican."[7] In other words, Dr. Barber's observation implies that when we examine racial sorting among Independents in North Carolina, we are in fact very often observing racial sorting among voters who tend to support Republican candidates. In any case, the observation that there are few Black Republicans does little to take away from the basic observation in my initial report, that racial sorting appears to have occurred *within* each partisan category.

In any case, neither Dr. Trende nor Dr. Barber challenges the size of the raw differences between racial groups on either side of district boundaries among Democrats and Independents set forth in my initial report. Nor do they cast doubt on the observed racial differences between those moved into and out of the districts of the prior plan that are present within each partisan category. Nor do they explain how these differences might be consistent with a story of pure partisan sorting. In sum, none of their critiques and observations refute the basic conclusions from my earlier analysis.

Dr. Barber's simulations

In Figure 4 above, I demonstrated that the distribution of BVAP across districts in the 2023 Plan departs radically from what would be expected from a race-blind draw. However, one might point out that since race and party are so highly correlated, this is exactly what we would expect to see if the legislature was drawing an extreme partisan gerrymander and extreme racial sorting was the only way to achieve it. Fortunately, when one conducts 5,000 simulations, as Dr. Barber provides, a small number of them will, by chance, strongly resemble a partisan gerrymander. In this case, the average plan in Barber's 5,000 simulated plans produced 8 Republican seats. However, the algorithm occasionally happens upon plans that are especially beneficial to one party or the other. For instance, around 100 plans produced 8 Democratic-leaning seats and 6 Republican-leaning seats. And, especially useful here, the algorithm produced 102 plans with 10 Republican-leaning seats—just like the 2023 Plan— and even 5 plans with 11 Republican-leaning seats. To see

[7] Barber and Imai, Op cit., page 11.

whether extreme racial sorting was required to produce an extreme pro-Republican map, we can simply compare the distribution of BVAP across districts, ranked by BVAP, in these very pro-Republican simulated plans with the distribution of BVAP in the 2023 Plan. If a similar style of racial sorting was necessary to produce 10 (or 11) Republican districts, the observations for the 2023 Plan should fall within the range of the race-blind simulations at each rank.

Figure 6: BVAP and BVAP Rank in 2023 Enacted and Simulated North Carolina Congressional Plans, where Simulated Plans Produce at Least 10 Republican Seats

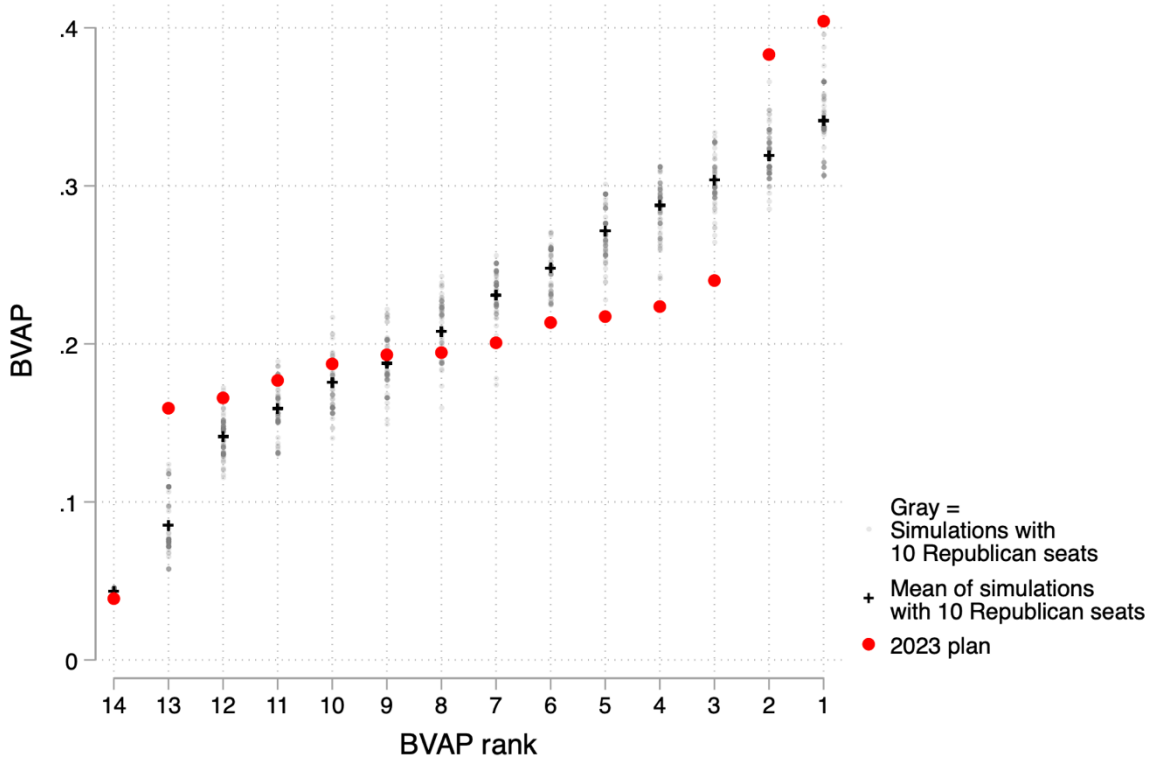


Figure 6 shows that this is not the case. Black voters are more concentrated in Districts 1 and 12 on the far right of the graph than in *any* of these very pro-Republican simulated plans, and BVAP is far more dispersed across the remaining districts than in the simulations. Even when comparing it to these very pro-Republican plans, the districts with the third, fourth, fifth, and sixth-highest Black populations in the 2023 Plan all had lower BVAP than *any* of the pro-Republican simulated maps. This provides a strong indication that to draw an extremely pro-Republican congressional plan in North Carolina, it was not necessary to concentrate Black voters in such an extreme fashion in Charlotte or the Northeast or to break up Black voters so artfully in several districts in the Piedmont Triad and beyond.

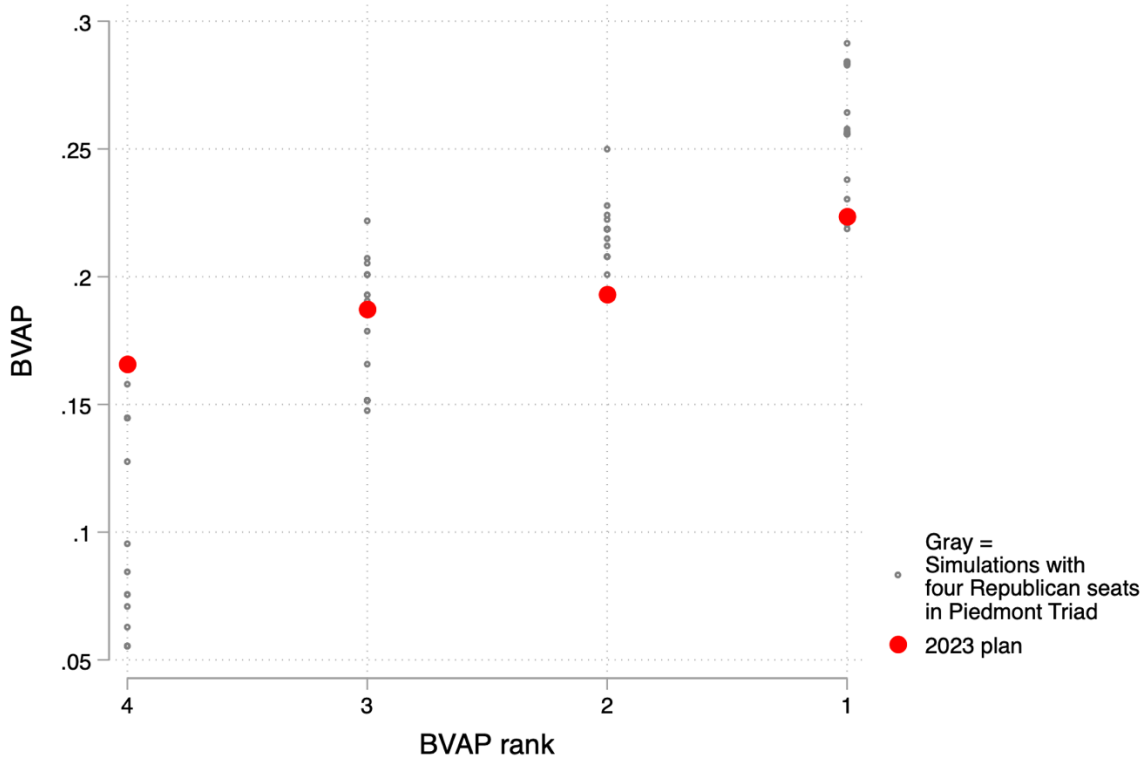
County splits and compactness scores in the 2023 Plan are within the range of Dr. Barber's simulations. In setting up his simulations, Dr. Barber instructed the algorithm to attempt to create 13 county splits, compared to the 2023 Plan's 14 county splits, and to generate moderately compact

districts. On average, the simulations produced a median Polsby-Popper score of .29, compared to .27 in the 2023 Plan.

It is also useful to explore the specific challenged regions more carefully. Figure 6 above ranks the simulated districts by BVAP, which means districts from different parts of the state will be represented at each specific rank in the plot of simulated plans (because the BVAP ranking for, say, a Winston-Salem-area district will change from one simulation to another). To zoom in on the area around the Piedmont Triad, we can examine all the simulated districts that include some part of the counties of the Piedmont Triad Metro Area, focusing only on the simulated plans that mimic the 2023 Plan and produce exclusively Republican districts throughout the area.

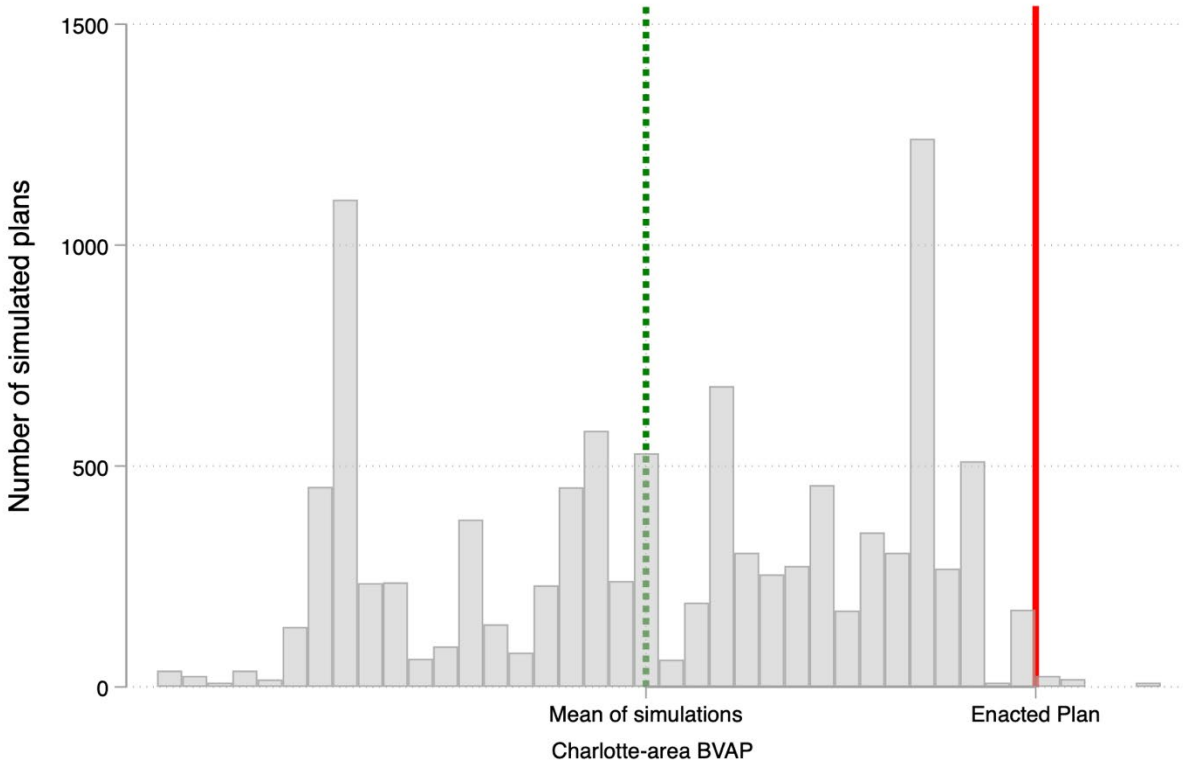
A first observation from this exercise is that the simulations very rarely produce a clean Republican sweep in the Piedmont Triad area. Only 17 of the 5,000 simulations produced four Republican-leaning districts in the Piedmont area. This lends credence to Dr. Barber's and Dr. Trende's characterization of the 2023 Plan as a very extreme Republican gerrymander. However, it is also clear that the extreme efforts to "crack" the Black communities of the Piedmont Triad were not necessary to achieve that result. Figure 7 is similar to the previous graphs, but it focuses only on the four Piedmont Triad area districts, using only the simulated plans that produced a clean Republican sweep of four districts. It shows that even focusing on these extremely pro-Republican plans, the 2023 Plan had a far more compressed distribution of Black voting-age population than the simulated plans. The simulated plans had significantly higher BVAP in two districts, and significantly less in one. The General Assembly generated a very tight range of BVAP in the Piedmont Triad area between 17 percent and 22 percent. Figure 5 clarifies that this tight range was not necessary to produce four Republican seats in the Piedmont Triad area.

Figure 7: BVAP and BVAP Rank in Enacted and Simulated North Carolina Congressional Plans for Districts in the Piedmont Triad Area where Simulated Plans Produce Four Republican Seats



Next, we can conduct the same exercise for the Charlotte area, making sure to focus on simulated plans that match the partisanship of the 2023 Plan by only producing a single Charlotte-area Democratic-leaning seat. In fact, this outcome is not terribly unusual: it emerges in 2,185 of the 5,000 simulations. But among those simulations that sufficiently pack Democrats in Charlotte to avoid the emergence of a second Democratic district, in the district with the highest BVAP—in practice, the most Charlotte-centric district— the average BVAP is 32 percent, compared to 38.3 percent in the 2023 Plan. The distribution of BVAP in the district with the highest BVAP in each of the simulated plans—focusing only on those plans that "pack" Democrats and avoid a second Democratic-leaning district—is presented in the form of a histogram in Figure 8, with the BVAP of the 2023 Plan indicated with solid red line, and the mean of these simulations indicated with a dashed green line. Figure 8 demonstrates that the BVAP of the 2023 Plan is in the far-right tail of the distribution, indicating that Black voters were quite packed in District 12 of the 2023 Plan even relative to a large number of race-blind simulated maps that achieved the goal of avoiding a second Democratic district.

Figure 8: Distribution of Maximum Charlotte-Area BVAP in Simulations that Produced Only One Charlotte-Area Democratic-Leaning District



We can also go further and examine only the simulated plans where Democrats are just as packed in the Charlotte district, or even more packed, than in the 2023 Plan. There were 94 simulated plans in which the maximum Charlotte-area Democratic vote share was equal to or greater than that of the 2023 Plan. Only three of these had BVAP higher than the 38.31 percent of the 2023 Plan. In other words, when Mecklenburg County's districts were drawn without regard for race, Dr. Barber's simulations discovered 94 different ways of achieving the very extreme packing of Democrats achieved by the 2023 Plan, yet in only around 3 percent of those were Black voters as packed as in the 2023 Plan.

Finally, I examine the Northeastern part of the state by identifying all the simulated districts that contained, in whole or part, any of the counties of the envelope of District 1 in the 2023 Plan. In the 5000 simulations, BVAP above 40.42 percent for District 1 in the 2023 Plan was extremely rare in this region. This happened in 85 of the 5,000 simulated plans (1.7 percent).

Draft Maps

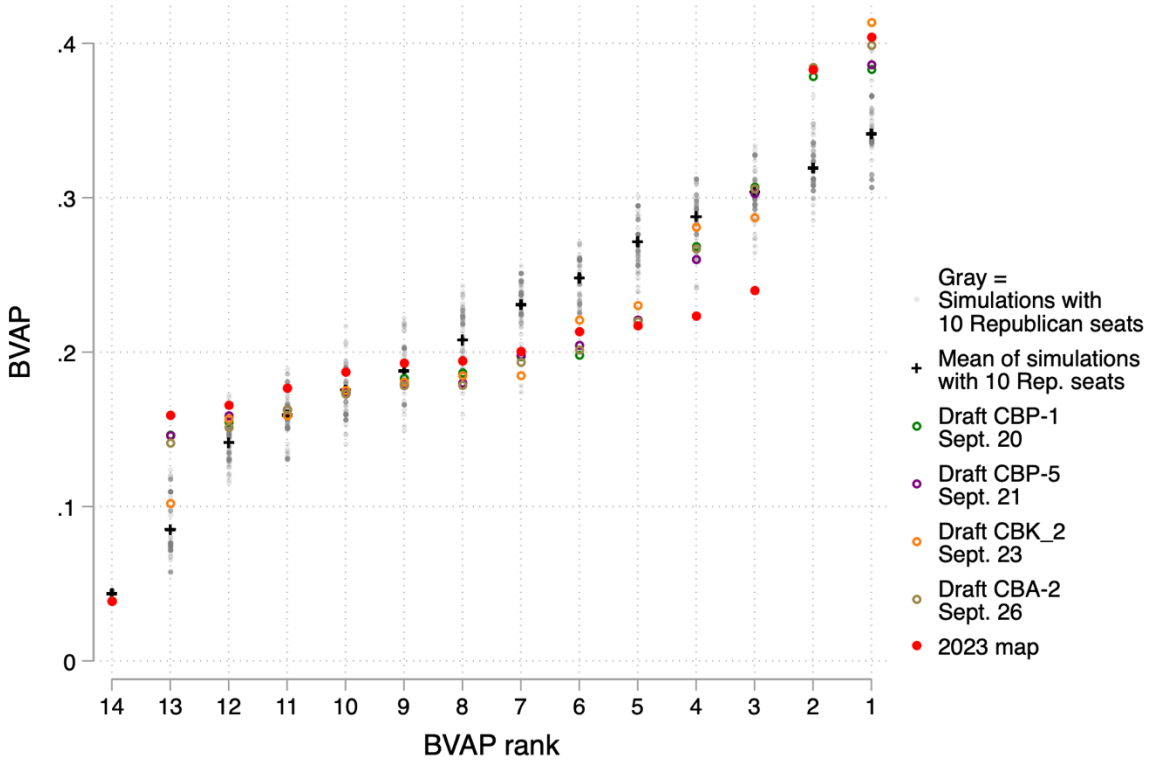
In addition to Dr. Barber's simulated maps, I was provided by counsel with a set of draft maps that were produced by Legislative Defendants in the form of block assignment files. Each map had a name and a date. It is my understanding that these were draft maps considered by legislators who were responsible for drawing the congressional plan. Some were earlier iterations of the 2023 Plan and some were iterations of another proposed plan. I examined each of the maps and noted that some were extremely similar or identical to one another. I identify three distinct groups of maps

that were clearly related to one another but where the individual drafts were sufficiently different from one another to warrant their own analysis. I examine them by date as they evolved within each group.

One group of maps, drawn by Senate Redistricting Committee co-chairs, aimed to produce 11 Republican-leaning districts, one more than the 2023 Plan. These maps had the names CBP-1 (dated September 20, CBP-5 (dated September 21), CBK-2 (dated September 23), and CBA-2 (dated September 26). These maps evolved to resemble the 2023 Plan in the Charlotte area, but they were quite different in other parts of the state, including the Piedmont Triad. To visualize the evolution of this group of maps, see Appendix 2.

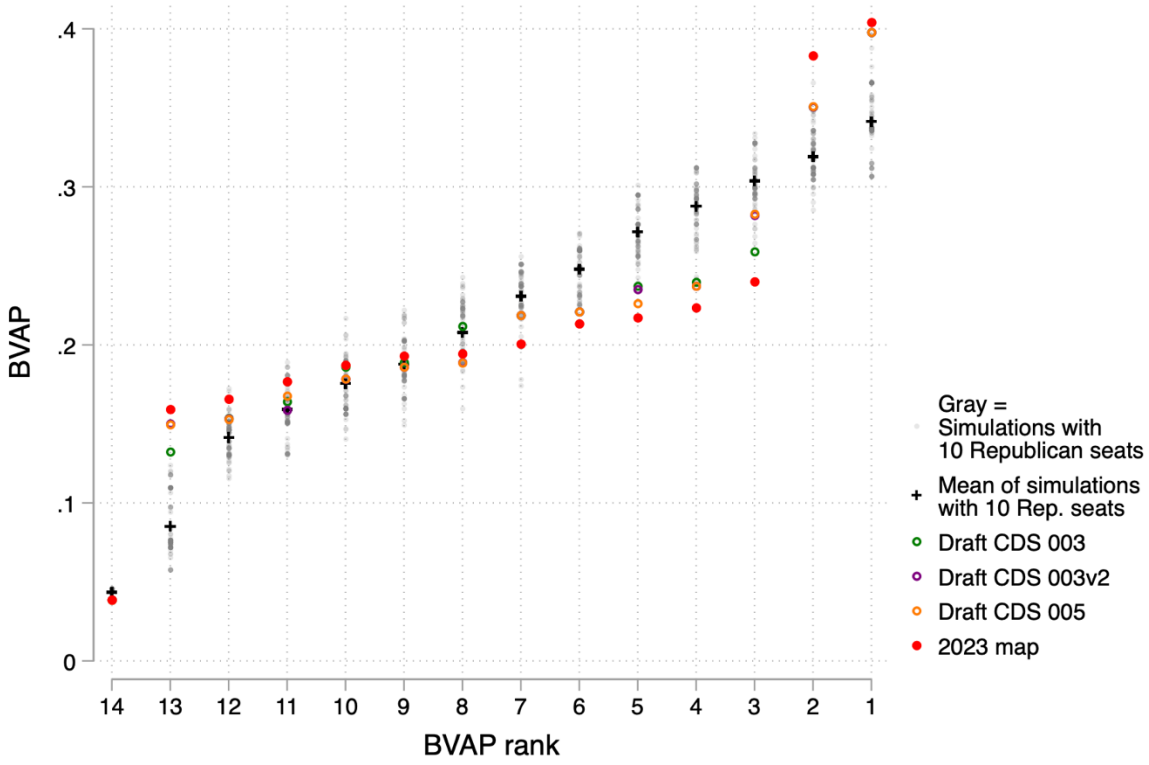
In Figure 9, I provide another graph of BVAP against BVAP rank, including the set of Dr. Barber's simulated plans that produced at least 10 Republican districts. One of the first things to notice in Figure 9 is that even relative to the set of simulations that produced 10 Republican districts, this family of draft maps produced an unusual distribution of BVAP. Already in these September drafts, Black voters were far more concentrated in the top two districts than in the most pro-Republican simulated plans. And in a couple of the districts in the middle of the distribution, the BVAP of the draft plans fell below that of the entire range of the simulations with 10 Republican seats. But in much of Figure 7, the observations for the draft plans are somewhere in the range of the pro-Republican simulations. For instance, this is true of the third- and fourth-ranked districts.

Figure 9: BVAP Arrayed by Rank, Pro-Republican Simulated Plans and Draft Maps from September



The red dots in Figure 9 represent the 2023 Plan. Clearly, something changed between September 26 (CBA-2) and October 20 (2023 Plan). In the third- and fourth-ranked districts, the BVAP dropped precipitously, and the BVAP of the fifth-ranked district dropped as well. Meanwhile, on the other side of the graph, the BVAP in all the districts with smaller Black populations was increased, beyond even the most pro-Republican simulations, and beyond even these extremely aggressive pro-Republican draft maps that produced 11 Republican seats. The result, as described above, was an unusually constrained distribution of BVAP relative not only to the simulations, but to this family of draft maps. This is achieved by breaking up urban Black neighborhoods, thus lowering the BVAPs of the districts on the right side of the graph (other than the top two), and combining them with faraway rural places, thereby increasing the BVAP of the districts on the left side of the graph.

Figure 10: BVAP Arrayed by Rank, Pro-Republican Simulated Plans and Draft Springhetti Maps

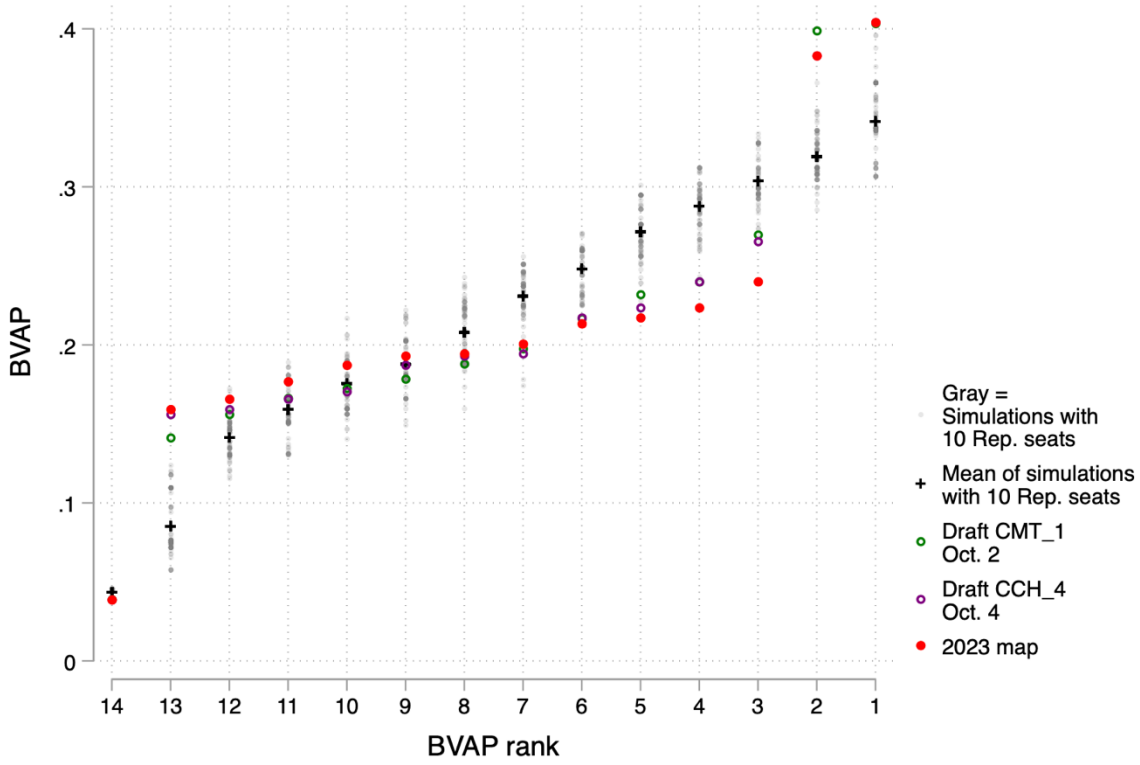


Next, I examine a series of undated maps drawn by Mr. Springhetti, who was a map drawer retained by the North Carolina House of Representatives to draw House and congressional map drafts. He received instructions and ongoing directions from Committee Chairs, but his plans were ultimately abandoned. These included 10 relatively safe Republican seats. The pattern, displayed in Figure 10, is like that of the previous set of draft maps in the CBP family of maps. The BVAP was in a narrower range in the Springhetti drafts than in the pro-Republican simulations, indicating an unnatural cracking of Black neighborhoods. But again, the 2023 Plan goes much further in its

efforts to achieve a highly unnatural distribution of BVAP across districts than the maps produced by Mr. Springhetti. In sum, Mr. Springhetti's maps achieved similar partisan goals as the 2023 Plan, but with a rather different treatment of Black voters.

Finally, let us examine the final set of draft maps from which the 2023 Plan evolved in October: CMT-1 (dated October 2) and CCH-4 (dated October 4). The evolution of these maps can be visualized in Appendix 2, which contains images of each. These were also extreme pro-Republican gerrymanders that produced 10 safe Republican seats. These plans suppressed BVAP in the districts ranked 3 through 8 relative to the most pro-Republican simulated plans, and even relative to the September plans examined above or the Springhetti plans. It appears that as the process went on, the distribution of BVAP across districts became more and more distinctive in its compression, moving downward in the relatively high BVAP districts and upward in the relatively low BVAP districts. This was true of the move from the September maps to the October maps, and of the move from the early October maps to the final 2023 Plan later in the month.

Figure 11: BVAP Arrayed by Rank, Pro-Republican Simulated Plans and Draft Maps from October



Calculating summed squared deviations from the mean of the race-blind simulations, as introduced above, provides an overall indicator of the extent to which the distribution of BVAP deviates from the race-blind simulations. The average was .11 for the Springhetti maps, .12 for the September draft maps, .14 for the October draft maps, and .16 for the final 2023 Plan. In analyzing the evolution of the draft maps, we see that they became increasingly deviant from the race-blind simulations in terms of BVAP distribution over time.

In sum, the draft maps are helpful for assessing the role of race versus party. First, each of these maps was an extremely effective pro-Republican gerrymander—in some cases perhaps even more effective than the 2023 Plan. Each of these draft maps already demonstrated a very unusual distribution of BVAP relative to a sample of race-blind simulations that produced a similar number of Republican-leaning seats. Second, over time, the distribution of BVAP became more unusual, and the final 2023 Plan was a more extreme outlier on this dimension than any of its predecessors. It was clearly possible to draw an exceptionally strong partisan gerrymander without going to such great lengths to break up urban Black neighborhoods and increase the BVAP of rural districts. In fact, the General Assembly considered but rejected or altered several such maps.

IV. CONCLUSION

In conclusion, none of the critiques offered by Dr. Trende or Dr. Barber undermine the basic descriptive facts offered in my initial report. Even if I take the recommendation of Dr. Trende by focusing only on racial differences across border VTDs or compare the 2023 Plan with the race-neutral computer-generated plans of Dr. Barber, I reach the same conclusions: the 2023 Plan sorted voters by race.

Similarly, Dr. Trende and Dr. Barber make claims about the primacy of politics over race that are inconsistent with the data. First, racial sorting is present *within* each partisan group. Second, the distribution of race across districts deviates from Dr. Barber's race-blind simulations even in a sample of plans that achieve similar partisan goals to those achieved by the General Assembly. Finally, Black voters are more "packed" and "cracked" in the 2023 Plan than in a series of alternative plans considered by the General Assembly, each of which achieved very similar partisan goals as the 2023 Plan.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Executed on October 17, 2024.

Jonathan Rodden

Appendix 1: BVAP of Cross-Border Pairs in Split Counties of Piedmont Triad and Charlotte

Districts 5 and 9

D5 Border VTD	BVAP D 5	BVAP D 9	Difference
37081000CG1	0.246	0.079	0.168
37081000CG2	0.117	0.079	0.039
37081000G06	0.864	0.354	0.510
37081000G53	0.710	0.478	0.232
37081000G55	0.663	0.527	0.136
37081000G57	0.570	0.527	0.043
37081000G59	0.483	0.527	-0.044
37081000G60	0.410	0.175	0.234
37081000G72	0.754	0.461	0.293
37081000SF1	0.065	0.079	-0.013
37081000SF2	0.042	0.063	-0.021
3708100CG3B	0.183	0.137	0.047
3708100FEN1	0.550	0.302	0.248
3708100JEF3	0.675	0.278	0.398
3708100MON1	0.525	0.314	0.212
370810MON2A	0.631	0.255	0.376
Average			**0.179**

Districts 6 and 9

D6 Border VTD	BVAP D 6	BVAP D 9	Difference
37081000FR1	0.362	0.182	0.180
37081000FR2	0.139	0.182	-0.043
37081000G61	0.513	0.175	0.337
37081000G65	0.310	0.178	0.132
37081000G66	0.256	0.182	0.075
37081000H04	0.310	0.051	0.259
37081000H05	0.574	0.051	0.523
37081000H06	0.323	0.111	0.211
37081000H10	0.667	0.151	0.516
3708100H19B	0.285	0.151	0.134
Average			**0.232**

Districts 10 and 6

D10 Border VTD	BVAP D 10	BVAP D 6	Difference
37067000072	0.099	0.075	0.023
37067000073	0.034	0.075	-0.041
37067000082	0.356	0.145	0.210
37067000112	0.150	0.073	0.077
37067000123	0.204	0.108	0.096
37067000401	0.667	0.297	0.371
37067000501	0.668	0.320	0.348
37067000504	0.410	0.221	0.189
37067000505	0.429	0.273	0.156
37067000506	0.275	0.321	-0.046
37067000605	0.370	0.337	0.033
37067000708	0.242	0.108	0.134
37067000709	0.273	0.231	0.042
Average			**0.123**

Districts 6 and 8

D6 Border VTD	BVAP D 6	BVAP D 8	Difference
12-02	0.281	0.181	0.100
04-01	0.247	0.053	0.194
02-01	0.126	0.083	0.043
02-09	0.191	0.116	0.074
02-08	0.151	0.052	0.099
12-11	0.164	0.224	-0.060
04-02	0.282	0.053	0.229
12-07	0.696	0.419	0.277
12-01	0.182	0.181	0.001
12-03	0.143	0.124	0.019
12-08	0.163	0.109	0.054
Average			**0.094**

Districts 12 and 8

D12 Border VTD	BVAP D 12	BVAP D 8	Difference
37119000068	0.347	0.050	0.296
37119000070	0.020	0.054	-0.035
37119000072	0.058	0.020	0.039
37119000073	0.099	0.149	-0.050
37119000083	0.380	0.202	0.178
37119000085	0.218	0.050	0.168
37119000087	0.143	0.149	-0.006
37119000088	0.144	0.111	0.033
37119000092	0.114	0.149	-0.035
37119000096	0.152	0.050	0.102
37119000099	0.484	0.181	0.303
37119000102	0.339	0.181	0.157
37119000110	0.083	0.020	0.064
37119000115	0.325	0.202	0.123
37119000116	0.478	0.162	0.316
37119000118	0.111	0.056	0.055
37119000119	0.086	0.070	0.016
37119000129	0.285	0.149	0.136
37119000201	0.419	0.138	0.281
37119000217	0.142	0.116	0.025
37119000226	0.134	0.064	0.071
37119000235	0.291	0.174	0.117
Average			**0.107**

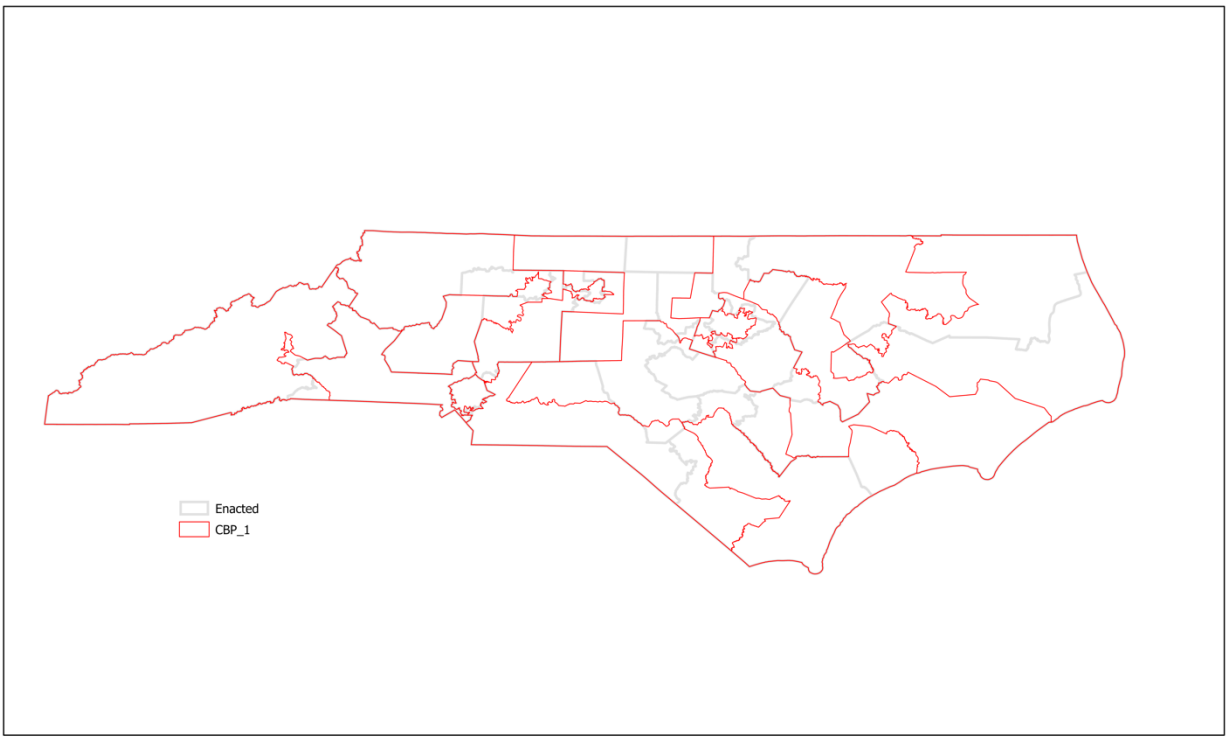
Districts 12 and 14

D12 Border VTD	BVAP D 12	BVAP D 14	Difference
37119000039	0.756	0.167	0.588
37119000053	0.673	0.167	0.506
37119000077	0.472	0.147	0.326
37119000079	0.431	0.265	0.166
37119000080	0.497	0.350	0.147
37119000087	0.143	0.159	-0.016
37119000088	0.144	0.115	0.029
37119000089	0.460	0.350	0.111
37119000097	0.453	0.147	0.306
37119000114	0.061	0.147	-0.085
37119000129	0.285	0.190	0.096
37119000138	0.416	0.374	0.041
37119000145	0.351	0.199	0.152
37119000147	0.349	0.374	-0.025
37119000150	0.448	0.163	0.285
37119000151	0.486	0.199	0.287
37119000211	0.552	0.186	0.366
37119000226	0.134	0.097	0.037
37119000228	0.366	0.335	0.032
Average			**0.176**

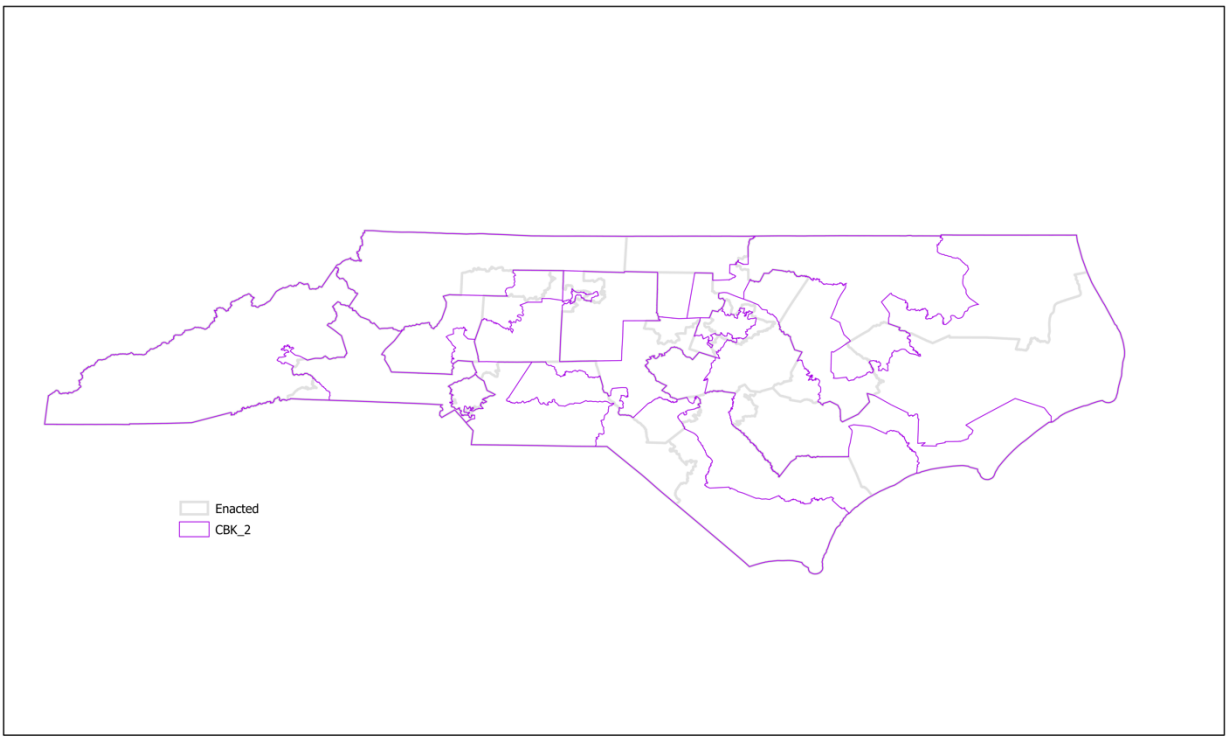
Appendix 2: Evolution of Draft Maps

September Maps

This is a group of draft maps that resembled the 2023 Plan in the Charlotte area, but not elsewhere. Draft maps are displayed in various colors, and the final 2023 Plan is displayed in gray. These maps produced 11 Republican-leaning districts.

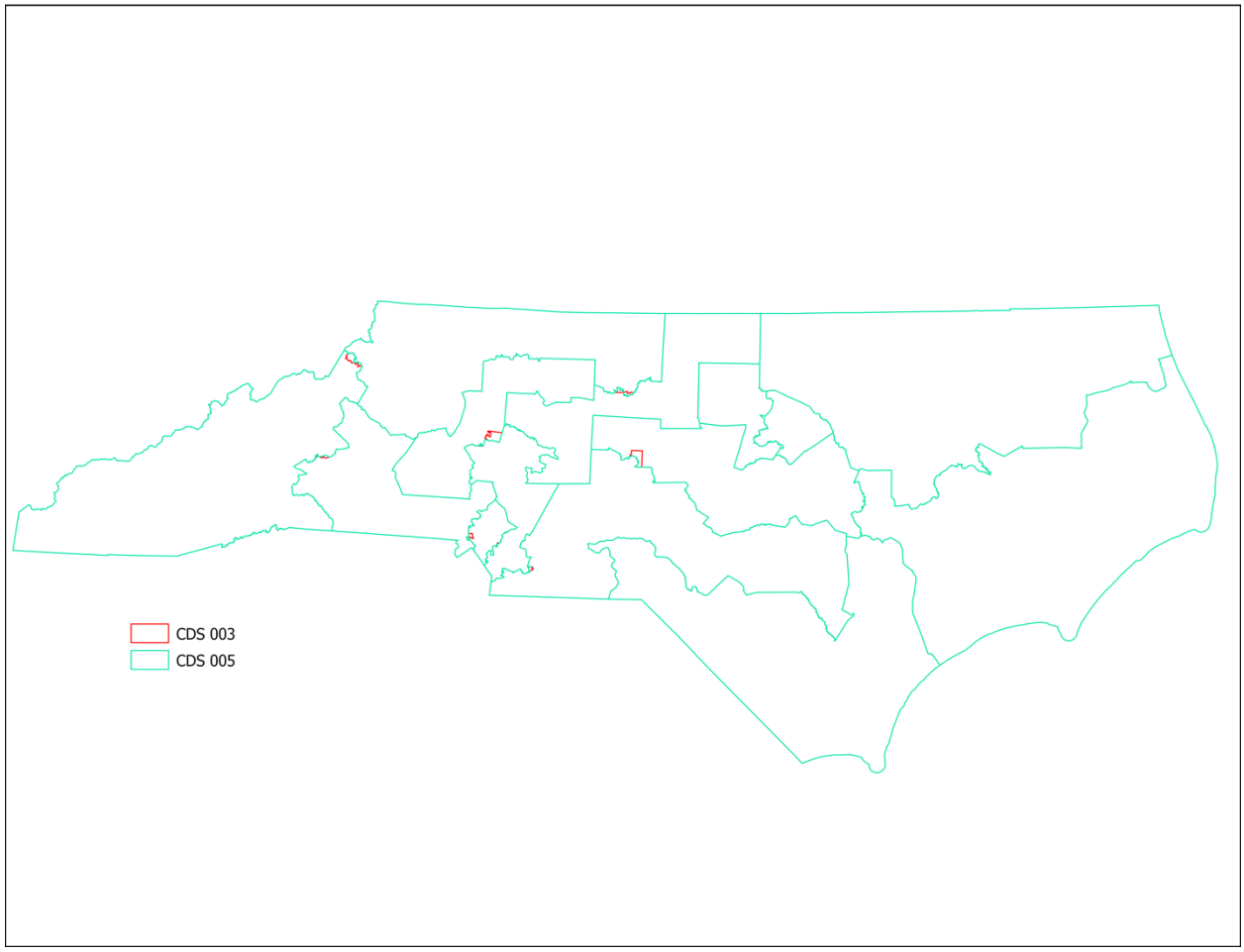



Enacted
CBP_5


Enacted
CBK_2

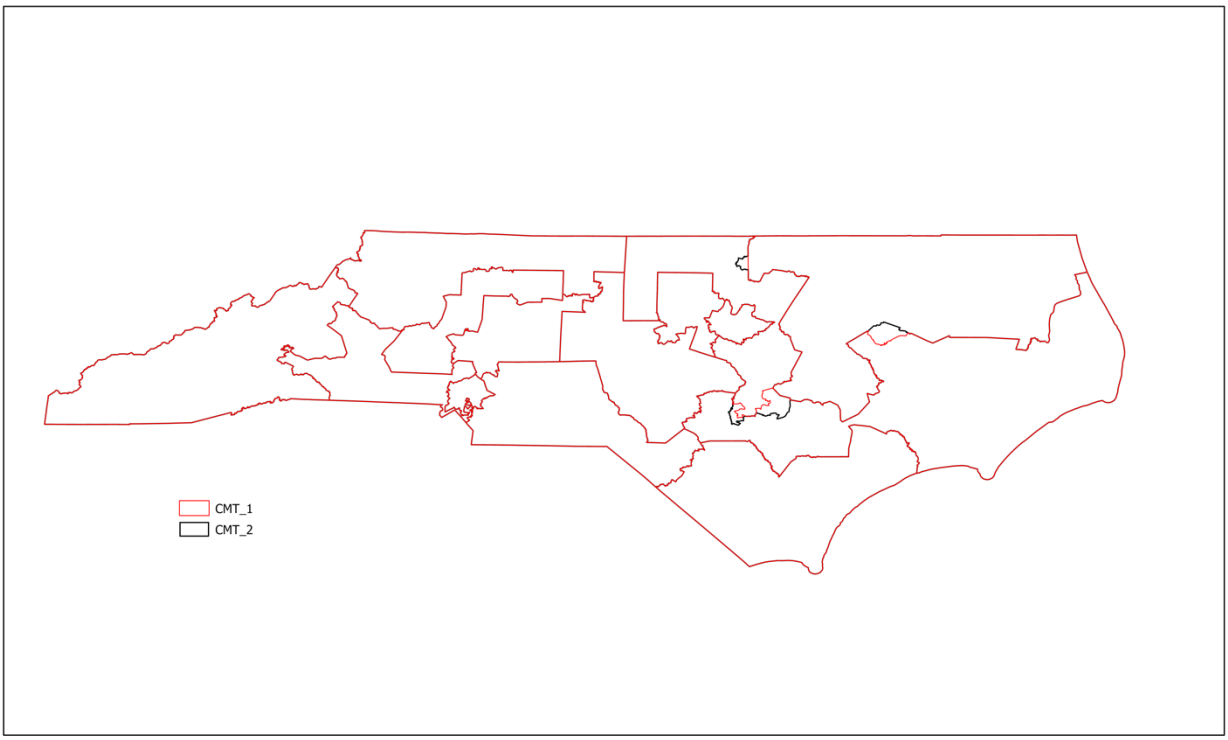

Enacted
CBA_2

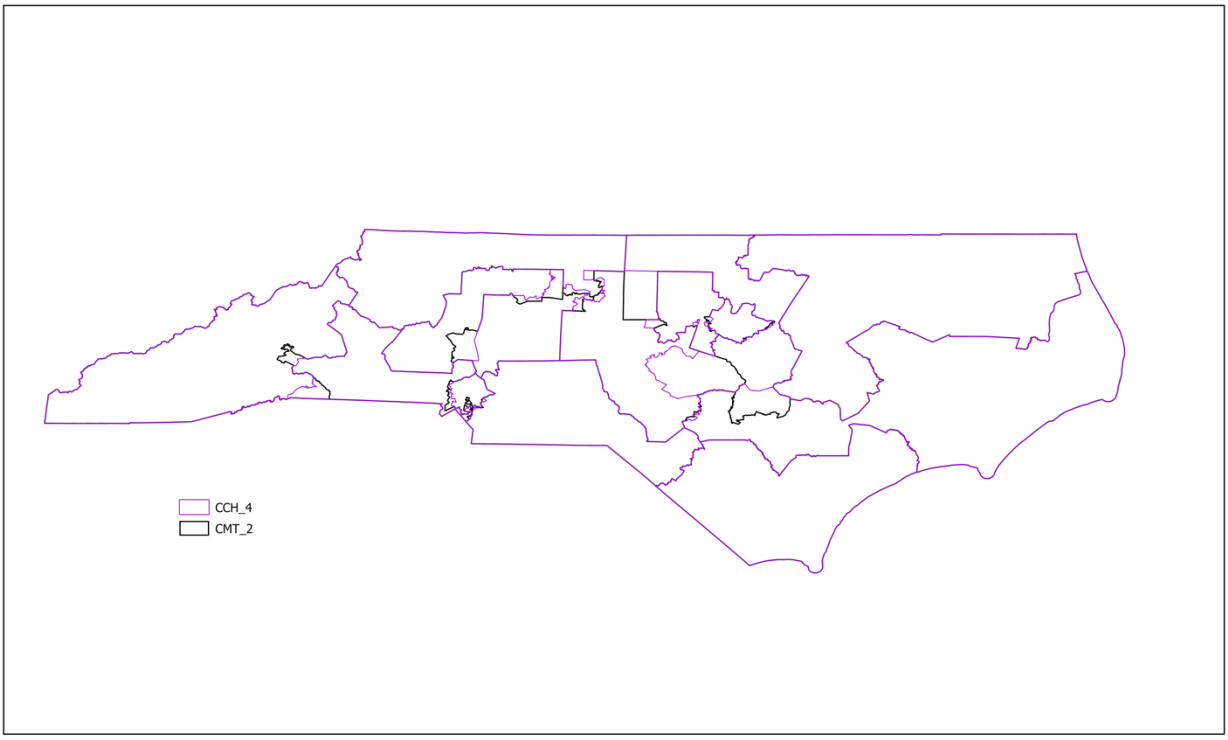
Springhetti Maps

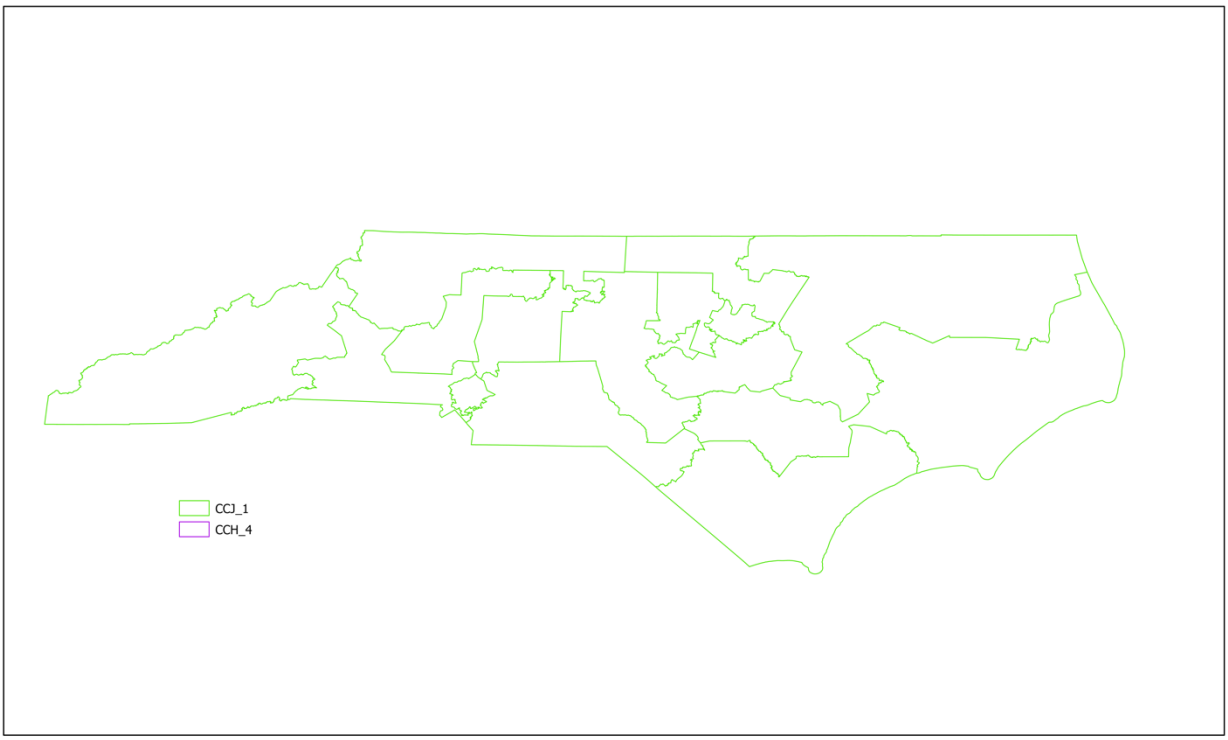


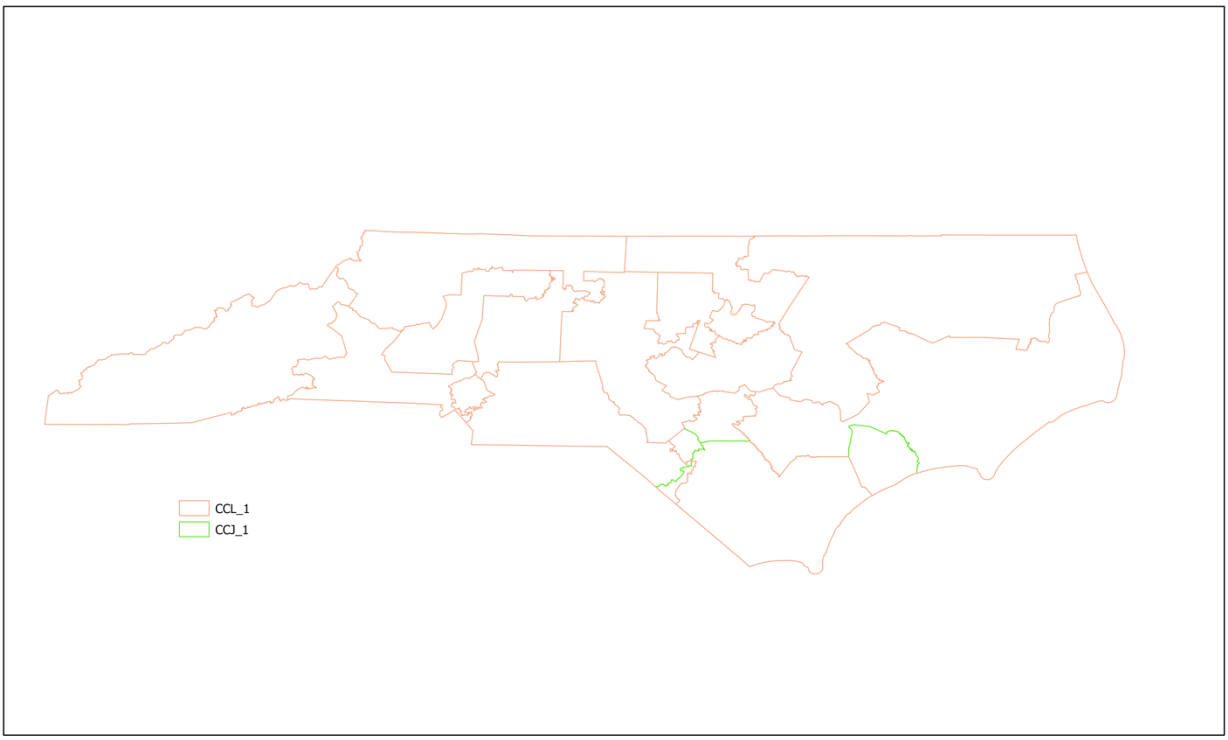
October Maps

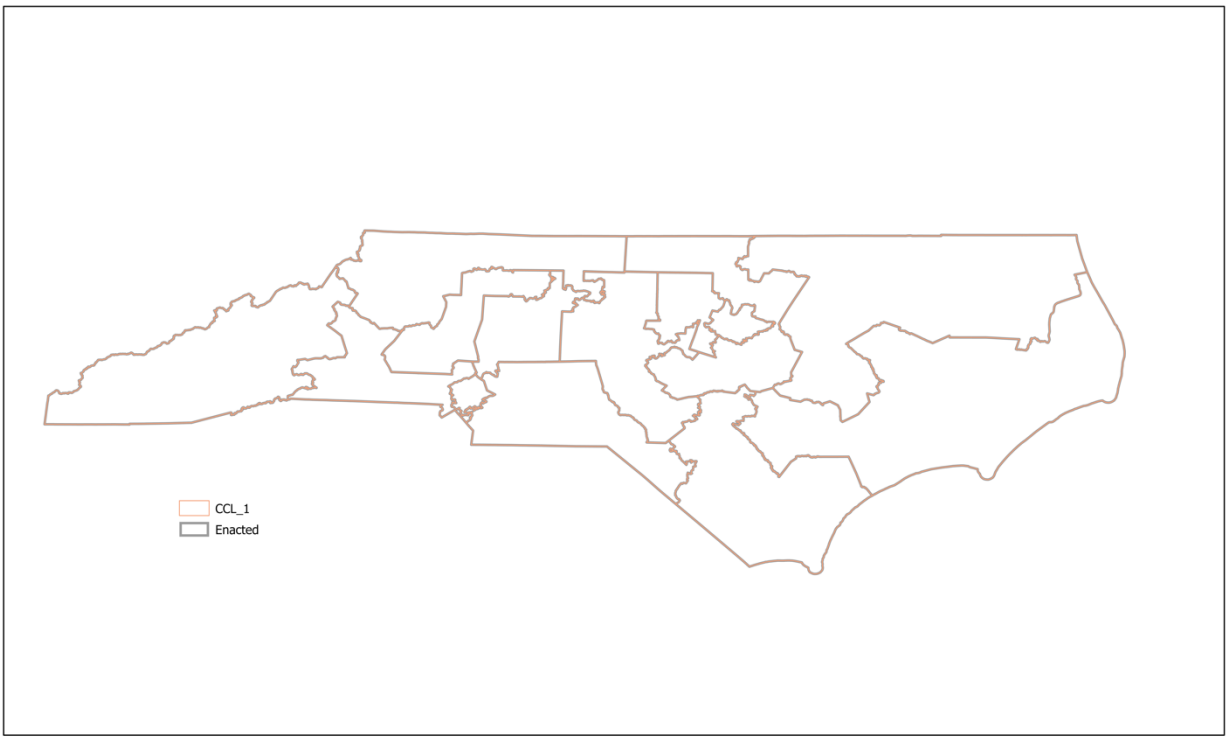
Next, I provide images of a group of maps that evolved into the final 2023 Plan. Each map contains the boundaries of one draft map and its immediate successor. Following through the maps allows one to see how the final map emerged. The final shape of District 1 emerges with the transition from CMT-1 to CMT-2. Important changes are made in the Piedmont Triad region from CMT-2 to CCH-4. Some changes are made in the Southern part of the state from CCJ-1 to CCL-1, which becomes the 2023 Plan.


CMT_1
CMT_2


CCH_4
CMT_2


CCJ_1
CCH_4


CCL_1
CCJ_1


CCL_1
Enacted